MARCH 1955

Power Engineering

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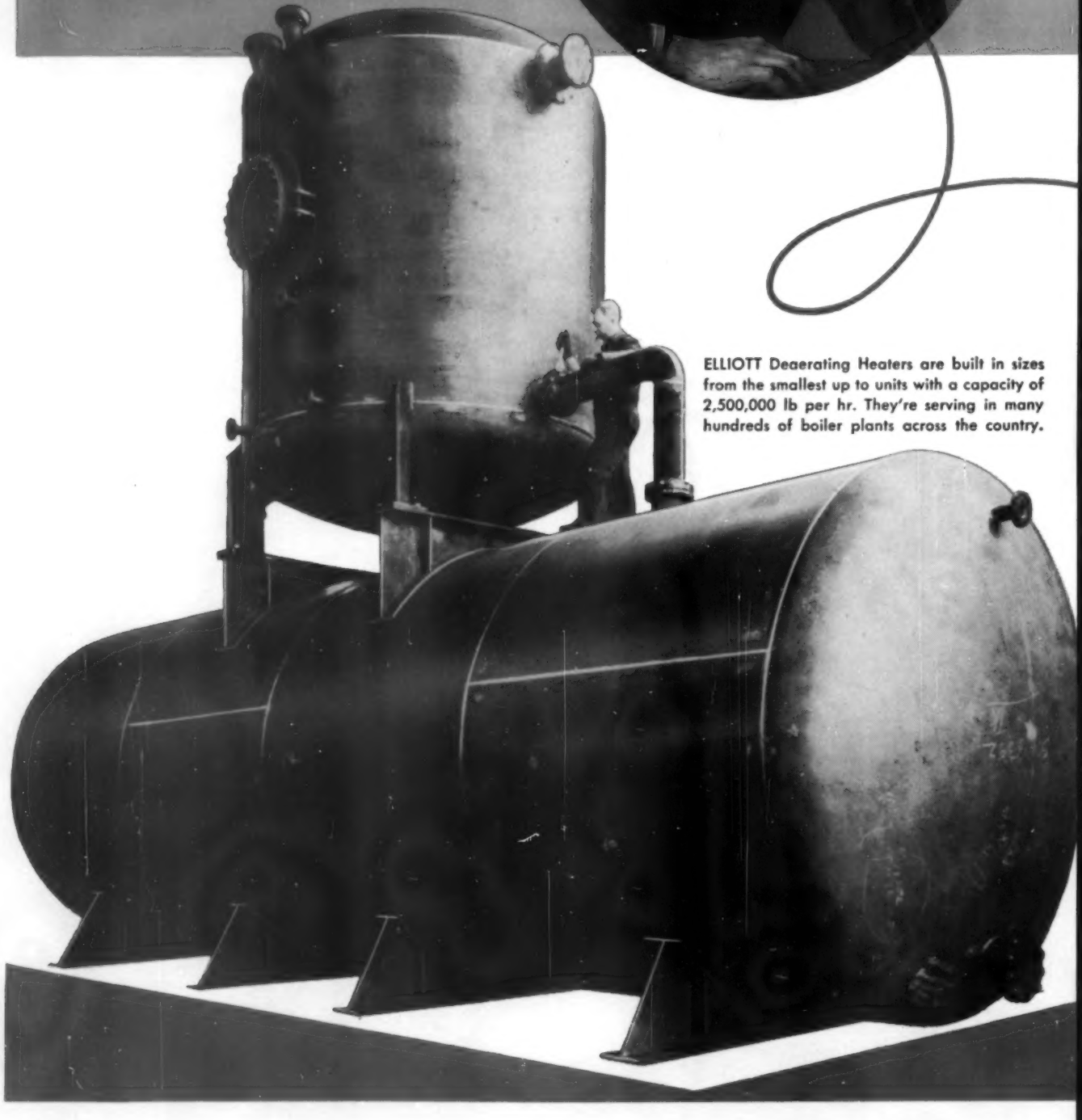

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At your call

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1. **THE ELLIOTT SALES ENGINEER.** He's factory-trained and thoroughly grounded in the principles of deaeration and their practical application. He can give your engineers valuable aid in the selection of the right deaerating equipment for your needs and in the solution of feedwater deaerating problems. You can reach him at the nearest of the district offices listed.

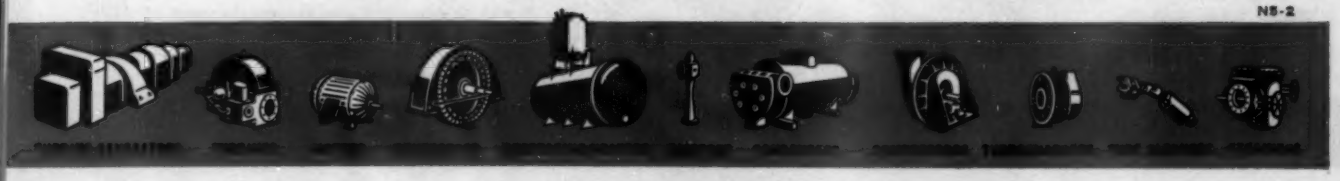
2. **THE ELLIOTT HEADQUARTERS MAN.** He's one of a group of trained personnel in the Jeannette, Pa., factory ready to apply his experience and skill in designing and fabricating equipment to the most exacting requirements.

3. **THE ELLIOTT FIELD SERVICE MAN.** He, too, is factory-trained and has the know-how to diagnose and correct operating difficulties. He's one of a corps located in selected centers all over the country. This 3-deep service team — plus Elliott Deaerating Heaters that represent the last word in deaerating efficiency, assure every installation of uninterrupted performance and the finest possible deaerating results. Call or write the nearest office or write Elliott Company, Deaerator and Heater Department, Jeannette, Pa.

WRITE FOR BULLETINS. Bulletin N-18 covers the science of deaeration in detail. Bulletin N-19 shows how Elliott deaerating feedwater heaters satisfy every one of the requirements.

ELLIOTT Company

N5-2



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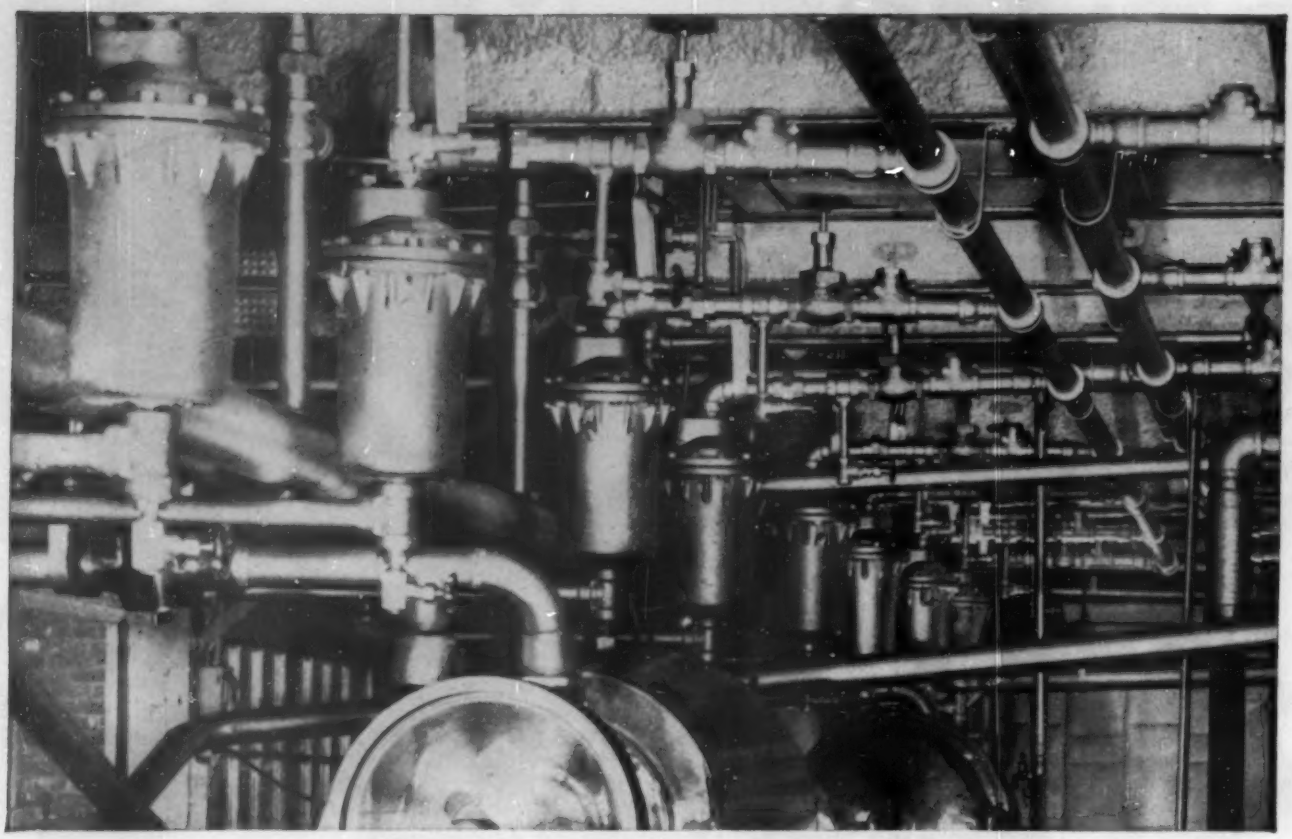


How To Increase Production and Still Use Less Fuel!

Problem—Cooking kettles at National Cranberry Company, South Hanson, Mass., couldn't produce enough to supply three recently speeded up canning lines. There was neither enough space nor steam supply capacity to add more kettles. Might there be another answer?

Solution—Mr. Russell Appling, Production Manager, made a very logical move, with everything to gain and nothing to lose. He called his local Armstrong Representative to talk about re-trapping his set-up. The existing traps were replaced with Armstrong 2" No. 216 large vent traps, one on each of the 8 kettles. Additionally, the steam lines were trapped to assure a dry steam supply.

Results—30% more kettle production. A fourth canning line was added to keep up with output. And, fuel consumption dropped 30% despite the production increase!

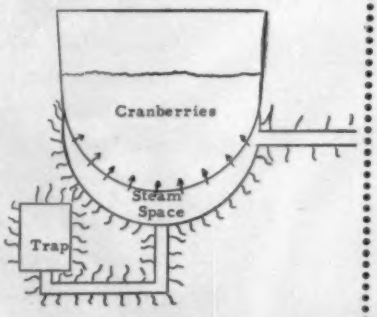
If you want more efficient production, greater return on equipment investment, why not call *your* Armstrong Representative. See your classified phone directory or Thomas Register, or write:

ARMSTRONG MACHINE WORKS
810 Maple Street, Three Rivers, Michigan

Application Engineered

ARMSTRONG STEAM TRAPS

HOW A KETTLE CAN GIVE *30% MORE OUTPUT WITH 30% LESS FUEL*



Assume that with trap "X", inadequate for the job, cooking time is 10 minutes. During that period heat is radiating (wavy lines) from supply lines, kettle and trap. This non-productive heat loss wastes steam. Now, with an Armstrong trap keeping the steam space free of air and condensate, heat transfer rate is fast and cooking is done in 6 minutes. Thus, four minutes of non-productive radiation loss is eliminated—the faster cooking actually saves steam.

For more data circle 502 on Post Card

ENGINEERS' PREVIEW

BRAZIL'S MOST IMPORTANT postwar hydroelectric power development, the 180,000-kw Paulo Afonso project, was dedicated on January 15 by President Joao Cafe Filho. Westinghouse Electric International Co. is supplying all electrical equipment for the huge development.

Two of the development's three 60,000-kw waterwheel generating units are now in operation at the new station, located between the states of Alagoas and Sergipe, 155 miles from the Atlantic Coast. The third unit is being erected.

The new station is the first of five similar power stations of the same capacity that will be erected by 1965 in order to utilize the entire 900,000-kw power potential of Paulo Afonso Falls on the São Francisco River, the second longest river in Brazil.

The new generators were installed in a subterranean concrete-supported power house that is 190 ft long and 49 ft high. Water to drive the turbines enters natural penstocks cut vertically in solid granite. It is then channeled by two diversion dams, one of which is 33 ft high and two and one-half miles long.

Two of the world's longest transmission lines, extending over mountainous northern and southern routes, will carry power from the plant site to the port cities of Recife and Salvador. The 220-kv lines are 250 miles and 285 miles long, respectively.

. . .

PUBLIC SERVICE CO. of Oklahoma has ordered two 125,000-kw outdoor-type reheat turbine generators, complete with condensers, from Westinghouse for an installation in Tulsa, Okla. The two units will be built with Westinghouse inner-cooled windings and Thermalastic insulation. Magnetic amplifier voltage regulators will be used to control both machines.

. . .

HOW EXPERTS BEND 20-in. pipe with walls 4 in. thick; how to sand-pack to prevent collapse in bending; how to heat alloy pipe and preserve its special characteristics; how to measure thinning in a bend; how to stress-relieve after bending or welding; how to cold bend pipe; hot swedging, extruding branch outlets, automatic welding, gamma ray inspection, hydrostatic testing, photomicrographic examinations — these are but a few of the trade secrets revealed in a new 16-mm color motion picture on Prefabrication of Power and Process Piping.

Prints for projection without charge are available to engineering societies and engineering departments of firms in the power, petroleum refining, chemical, pulp, paper and shipbuilding industries. Approximately one-half hour running time. For more information on how to get this film, write the Engineers' Preview Editor.

. . .

CONSOLIDATED EDISON has announced availability of a booklet titled Atomic Energy — How? It describes in simple language the process of nuclear fission. The company is issuing a series of booklets on various aspects of atomic energy. An earlier booklet is titled Atomic Energy — Why? Copies of either publication may be secured from the company's public information office at 4 Irving Place, New York 3. Con Edison has been studying the possibility of using atomic fuel for the generation of electricity for several years. Recently, the company announced it was considering an atom-powered installation to serve the growing electric needs of New York City.

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PUBLISHED SINCE 1896 FOR POWER ENGINEERS IN PRIVATE AND PUBLIC UTILITIES AND INDUSTRIAL PLANTS

ALFRED J. ORMSTON has been promoted to chief mechanical engineer of the Florida Power Corporation, H. K. McKean, vice president, has announced. Ormston succeeds Paul L. Bartow, who died January 14, and whom he has served as chief assistant for several years in the utility's big expansion program.

A mechanical engineering graduate of the University of Florida, Ormston joined the company in 1939 as a cadet engineer. He served in various engineering capacities with the company since that time, with five years out for Navy service during which he rose to Lt. Commander. He was promoted to assistant chief mechanical engineer in 1951 and prior to that served as assistant chief engineer of the Higgins Plant during its construction.

• • •

ENGINEERING SOCIETIES Library has prepared a Bibliography on Unionization of Professional Engineers to answer inquiries received by the Library from engineers, engineering students and others interested in the subject. The 100 references in the Bibliography are to pamphlets, and articles in magazines from 1937 to 1954 which are in the Engineering Societies Library. The publication is ESL Bibliography No. 10, is mimeographed, will cost you $2 and is available from the Engineering Societies Library, 29 West 39th Street, New York 18, N. Y.

• • •

FOR THE ENGINEERING and design of a 50,000-kw addition to the central De Lada power plant at La Felguera, Spain, a contract has been awarded to Gibbs & Hill, Inc., consulting engineers. The addition is to be erected by the Compania Electrica de Langreo to supplement its existing units there. The new extension will be equipped with a Westinghouse 50-cycle, 1250-psi, 950-F. turbine generator and with a Babcock & Wilcox pulverized coal and oil fired outdoor boiler.

• • •

FOR THE FIRST suggestion he submitted, Robert Felt, a 14-year veteran employe of Westinghouse Electric Corp.'s East Pittsburgh plant, has been awarded $4375. It is the fourth-highest amount earned in the 46 years of the firm's suggestion system, and the largest paid by the company since 1949. He earned the money for suggesting a new purchasing policy for insulating oil used in circuit breakers and transformers. As a result, both the company's switchgear division and the transformer division will realize large savings on the purchase and delivery of these oils.

• • •

SECOND INDUSTRIAL REVOLUTION, powered by atomic energy and controlled by automation, that will transform the American scene for business, labor and consumers, is taking shape rapidly here, even though it is not just around the corner, *The Saturday Review* reported in its annual business issue of January 19.

Problems and opportunities created for government, industry and labor by Atoms & Automation were analyzed.

A survey conducted by the Research Institute of America among the executives of more than 1,000 U. S. firms disclosed that roughly one-third expect to see the first atomic application in their industry within the next 10 years, and an even higher proportion look for extensive automation in their field within the same span of time. Furthermore, some 16 per cent see automation as a significant factor in their industries right now.

• • •

THE AMERICAN METER CO., 1513 Race St., Philadelphia, has announced that, as of December 1, 1954, The Philadelphia Pump and Machinery Co., Inc. has become a subsidiary of American Meter Company.

President of the subsidiary will remain Joseph A. Eagan. The vice-president is Wm. G. Hamilton, Jr. and secretary and treasurer is Wm. Ashby.

LETTERS TO THE EDITORS

Crites Says Title Is Misleading

THE November issue of POWER ENGINEERING presented on page 86 a short article entitled, "Standard Transformer as Voltage Regulator." There are two important points which I believe should be brought to your attention concerning this article.

The article itself is good and presents a satisfactory method of boosting the circuit voltage. However, the title of the article is very misleading. As the author, Mr. Ziemke, pointed out, the secondary winding of the transformer must withstand full line voltage to ground. A "standard" transformer will not meet this requirement. Therefore, a "standard" transformer could not be used for this application.

Secondly, the term "voltage regulator" commonly refers to a device which functions to maintain a specified voltage at a specified point in a circuit as the circuit loading and/or source voltage vary. A transformer connected in the manner described by the author does not maintain a constant voltage and, hence, does not serve as a regulator. The transformer connected as shown by the author will boost the voltage, but will not regulate it. — *W. R. Crites, Schenectady, N. Y.*

Ziemke's Answer: Buck Boost Tricks

I HAVE YOUR LETTER of November 30 with Mr. Crites' enclosure.

It is a fact that one must take every precaution by Megger, plus Hi-pot testing of the transformer to insure safety for the secondary winding when subjected to the increased voltage. Since being in government service, the need for improvising has not occurred for obvious reasons. But, in my many years in mining operations where the margin of profit is often very slim (Zinc concentrates are bringing $65 per ton now while the cost of production is $75.00 and difference comes from stone aggregate) we had to resort to buck boost tricks under many circumstances. Mining is like a war in some degree — you have to get it while the getting is to be had, or the place caves in over your head. — *Paul C. Ziemke, Oak Ridge, Tenn.*

Here's Help in Understanding STEAM-WATER CYCLE ANALYSES

OFTEN, constituents of deposits in steam-water cycles are reported to you in mineral names rather than chemical formulas. To help you better understand reports and analyses with these names, Allis-Chalmers has published a new Informational Bulletin, Number 59. It lists each mineral, then gives the chemical formula, the usual area in which these deposits are found, and the causes and possible preventive measures you can take.

Part of Practical Library

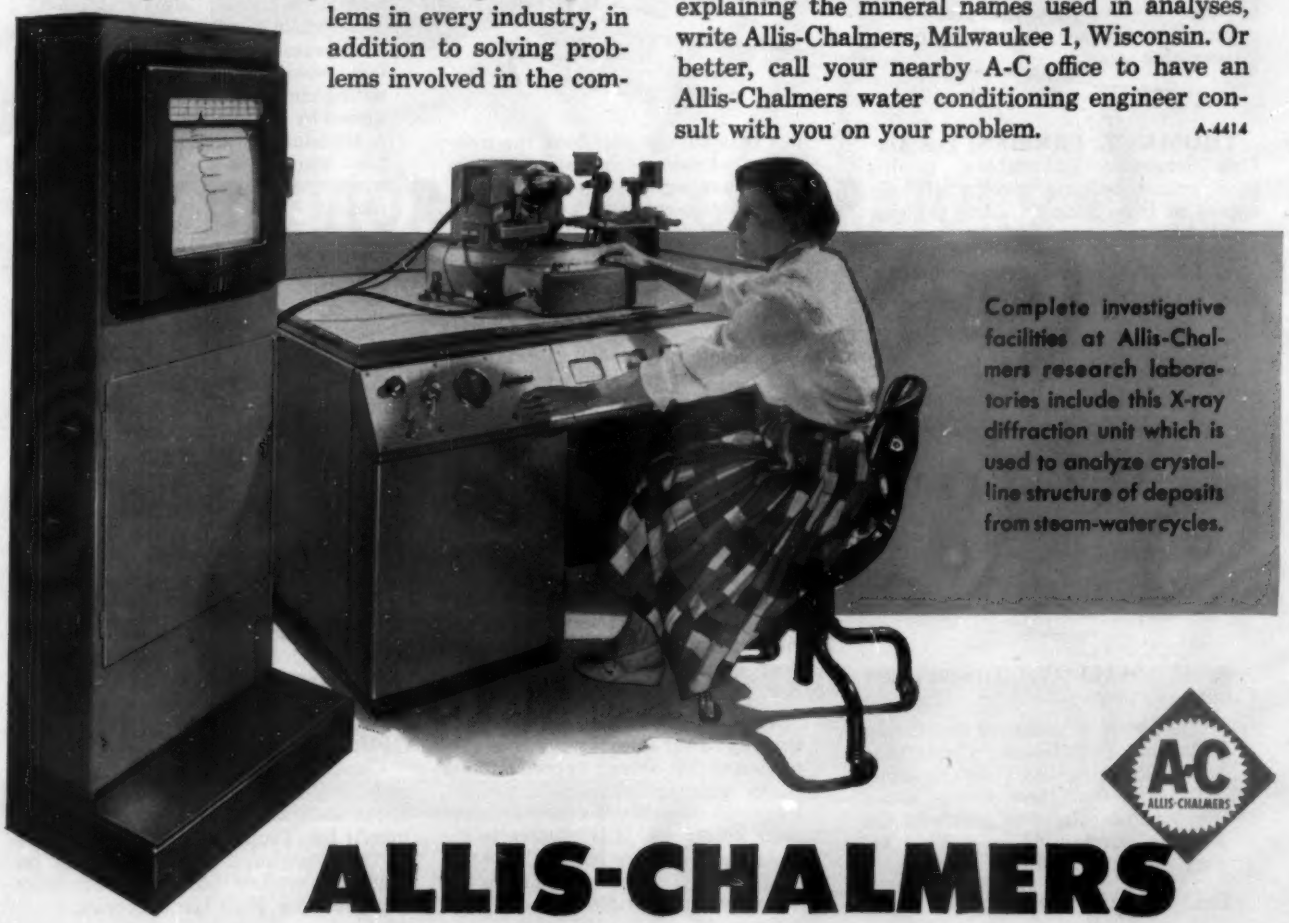
Only careful analysis of all the factors in the cycle can solve a specific water problem. This bulletin will help you understand, generally, the causes and solutions of a variety of water problems. It is one of a series published by Allis-Chalmers. These bulletins reflect Allis-Chalmers wide experience from years of solving water problems in every industry, in addition to solving problems involved in the company's own broad line of power plant equipment.

ALLIS-CHALMERS WATER CONDITIONING
Equipment — Chemicals — Service

Complete Water Conditioning Service

Allis-Chalmers offers complete water conditioning service. You can get analyses and reports on your problems. You can get chemicals needed for water treatment. And you can get the equipment needed for any system.

For your copy of Informational Bulletin 59 explaining the mineral names used in analyses, write Allis-Chalmers, Milwaukee 1, Wisconsin. Or better, call your nearby A-C office to have an Allis-Chalmers water conditioning engineer consult with you on your problem. A-4414



Complete investigative facilities at Allis-Chalmers research laboratories include this X-ray diffraction unit which is used to analyze crystalline structure of deposits from steam-water cycles.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

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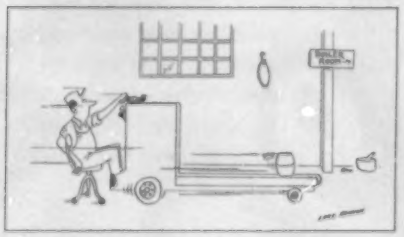
HERE'S WHAT THEY TELL US

COPY OF The Cyclone Furance — Latest Thing in Coal Burning, which we published in our April '50 issue, was sent to Furman E. Calvert of South Carolina in answer to his request for cyclone-burner information. Executive Editor Chester Earle also added the following comment:

> Fundamental principles and most of the details have changed very little since that time. A number of other installations have been made, and, in general, the results with all of them have been very satisfactory. In fact, it was just last month that I saw the unit pictured in Fig. 9 of the article, in full operation in a plant in New Jersey. One double that size will be put into operation in another plant of the same company this summer.
>
> All the units shown in the article are big ones, but the cyclone can be used on small boilers, too. An article is being written right now for POWER ENGINEERING, showing how the cyclone has been used on small units down to outputs of 60,000 or 70,000 lb of steam an hour, which is in the range of many industrial plant boilers. You will see the article in the magazine soon.

THOMAS E. CARMAN, Los Alamos Scientific Laboratory, in his note acknowledging receipt of four copies of Pipe Sizing Charts, February '54 issue, remarked:

> This is information in the concise available form in which we like it!



J. C. MALLOY, Armour and Company, wrote:

> The writer is interested in securing additional Paul Grogan charts that have been printed in your magazine.
>
> A booklet of these charts would not only be helpful to people in the field but much in demand. They are very clear and easy to handle.

Paul Grogan's charts on Graphical Boiler Heat Balance have been appearing for some time in almost every issue of POWER ENGINEERING. There is a possibility that these will be put into booklet form at a later date.

OUR EDITOR was intrigued with a letter from Lillian Stemp, author of an article in this issue. Vice-chairman of the Printing and Publishing Section, National Safety Council, and winner of the 1953 award for best paper submitted to Western Society of Engineers, Miss Stemp wrote:

> I can't begin to tell you what an excellent job you did in preparing A Power Plant Primer and I'm very grateful that I have a copy.
>
> While en route to New York, I reviewed it. The airline hostess became very interested. She said she had no

idea that anyone ever took the trouble to explain technical things in simple language.

Can you picture the two of us absorbed in your Primer!

Editor Kramer answered:

> It was thoughtful of you to write me. Needless to say your reaction pleases me very much. I was also very much interested in what the airline hostess thought of it.
>
> It so happens that I am flying via TWA myself this afternoon — to Philadelphia; so maybe I had better take a couple of Primers along.

R. S. LANE, Pocahontas Fuel Co., Inc., also complimented our editor for doing a fine job with A Power Plant Primer in getting the general subject across to the non-technical reader. But he was concerned too:

> We are planning to distribute Primers to our sales personnel to give them a better overall appreciation of power generation system. However, I have one question I wish you would clear up for me. It is relative to the use of temperature in your equation on page 18. To me it would seem this equation would indicate the quantities of heat rather than the temperature of the steam so that the efficiency would be: $E = \frac{Q_1 - Q_2}{Q_1} \times 100$
>
> I assume you use the term *temperature* in place of total heat, in an effort to get the general idea across to the non-technical reader more simply.

Yes, the total heat concept would have been more accurate but would also have made further explanation necessary.

ONE OF OUR READERS, in referring to the September 14 issue of *Atomics*, inquired:

> With respect to the second paragraph of your article, you state, "To quench such reactivity excursion before the fuel elements melt, steam bubbles must appear within a few hundredths of a second."
>
> This rate of heat transfer is very amazing and I wonder if you could give me some idea of the temperature at this point?

Editor Kramer replied:

> Concerning the temperatures involved in the Argonne Boiler Water Reactor Experiments, I am not sure of the exact temperature of the metal. As I indicated in my article, these steam-producing experiments were made using water-filled metal tubes ranging from one to 4 cm in diameter and from 10 to 30 cm in length. These were heated suddenly by the momentary passage of a low-voltage alternating current. This current was furnished by the low-voltage windings of a transformer and the duration of the transformer primary current surge could be controlled by an ignitron.
>
> Sufficient power was available to heat the tube wall to over 500 F within 0.01 second. (Oscillograms and test data are available to prove this).

WRITING TO Captain Robert Emerick in the Canal Zone, Editor Kramer suggested another means of communication. He said:

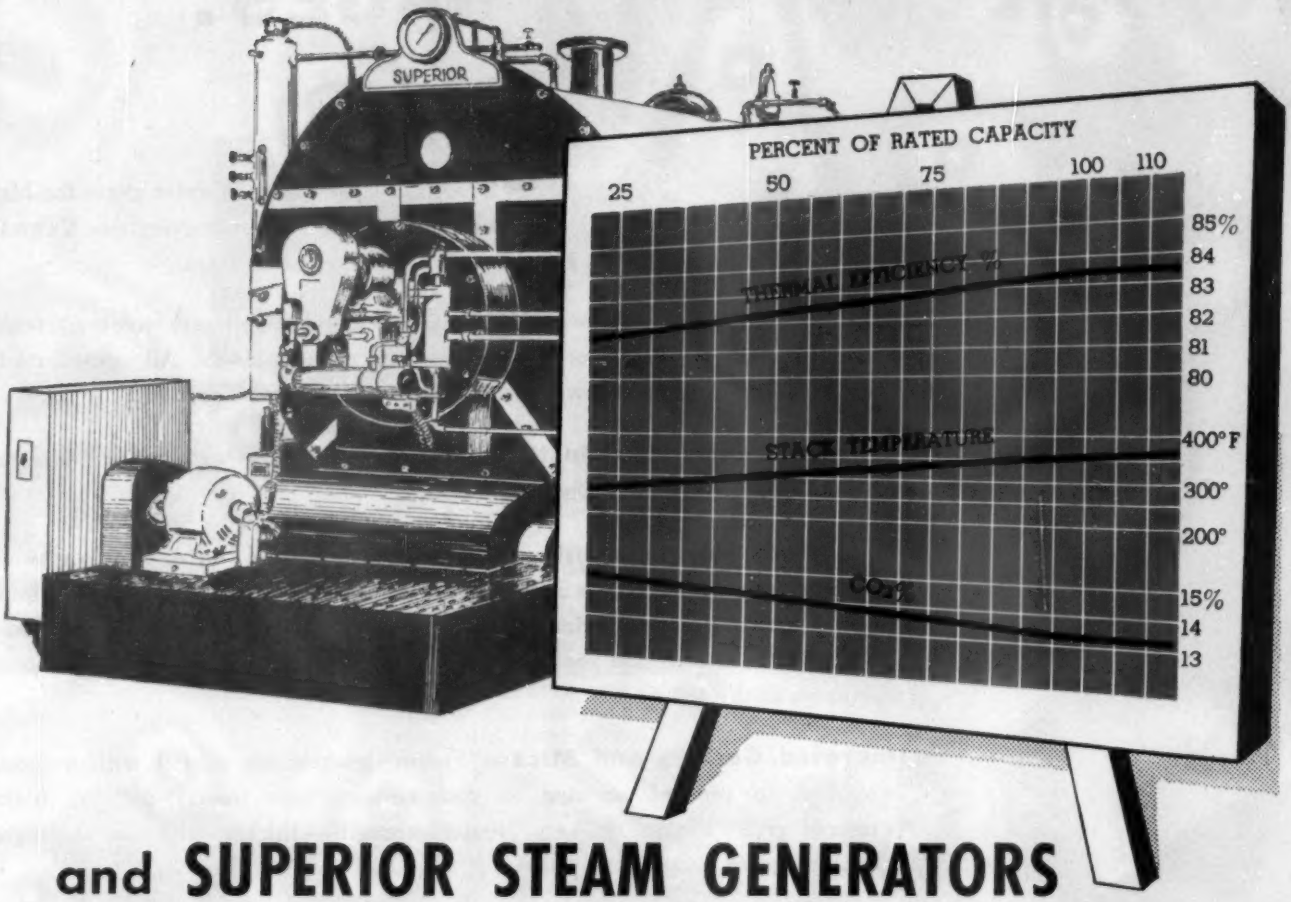
> I am wondering whether your son ever re-established his amateur radio station at Cristobal. If he has, please let me know what his call letters are and what frequencies he operates on. Perhaps we can arrange a schedule.

Just in case someone else may be interested, POWER ENGINEERING'S editor operates mostly on either the 7 or 14 megacycle bands, and can use either 'phone or CW. His call is W9 CPV.

Captain Emerick, by the way, was responsible for transmitting to POWER ENGINEERING The Ten Commandments for Technical Men. Reference to the Commandments was made on page 95, October '53. They were later reprinted by Hall Laboratories.

PERFORMANCE

is part of the PACKAGE



and SUPERIOR STEAM GENERATORS are rated for actual operating conditions

Superior Steam Generators are fully automatic, burning oil or gas or both. 18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. Write for catalog 706.

The payoff in performance is in your plant—here is where a steam generator must live up to the claims of its maker or you are the loser. Every Superior Steam Generator is "Performance Rated" on the basis of tests conducted under conditions duplicating those of actual service and is guaranteed on the results of these tests. The chart above shows typical performance of a Superior Steam Generator at 100 lbs. pressure. It is based on tests conducted by professors from Lehigh University on a boiler which had been in actual service for over a year. You can depend on results like these throughout a longer serviceable life when you specify Superior Steam Generators.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS

For more data circle 504 on Post Card

LOOK WHAT'S HAPPENING TO BOILER WATER GAGES.

There's a "new look" in water gages for high pressure boilers. You'll find it in every new YARWAY Flat Glass Boiler Water Level Gage.

YARWAY design and development engineers have made *twelve distinctive improvements* in YARWAY gages. All contribute to improved water gage service, longer water gage life.

Better Illumination—improved mercury vapor illumination makes meniscus "shine like a star".

Body Improvements—flanged connections and expansion bends eliminate stuffing boxes and *prevent distortion*—separated design in four-glass inserts permit freedom for expansion—stainless steel facing for gasket recess provides corrosion proof surface for the higher pressures—close machining tolerances insure top quality.

Improved Gaskets and Mica—"Frelon" gaskets are coated with a special compound to prevent sticking at disassembly—wire inserts for the higher pressures give "Frelon" gaskets greater strength—thicker mica for the higher pressure gages.

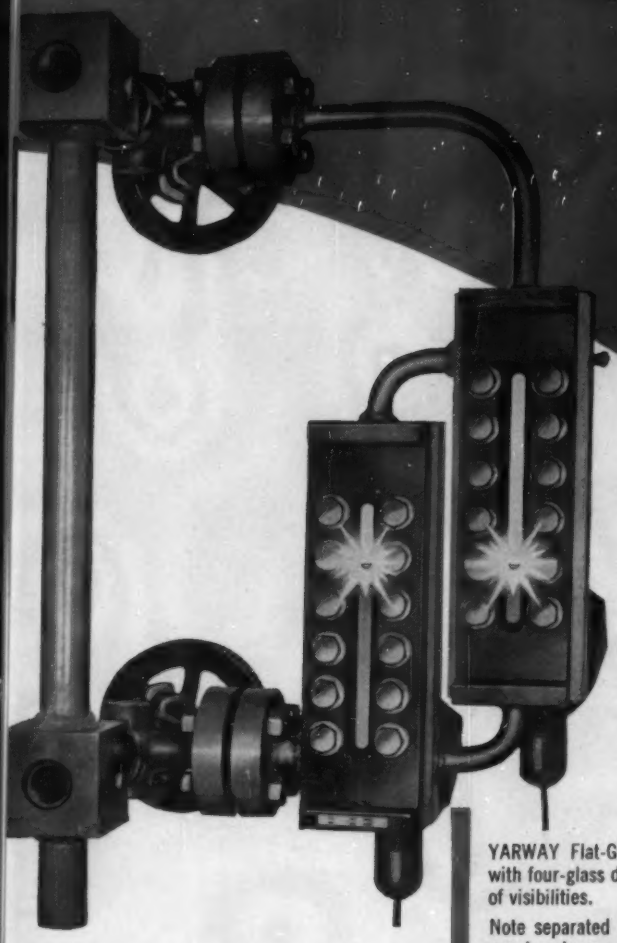
"Floating Assembly" Covers—improved capscrews have wider shoulders at face of body—improved spring cones reduce spring cone stresses.

Better Valves—YARWAY Welbond gage valves have integral stellite seats and stainless steel stems—Welbond water column shut-off valves have lock-open device.

YARWAY Gages are the "gages to see" on all new boiler units or replacements in high-pressure installations.

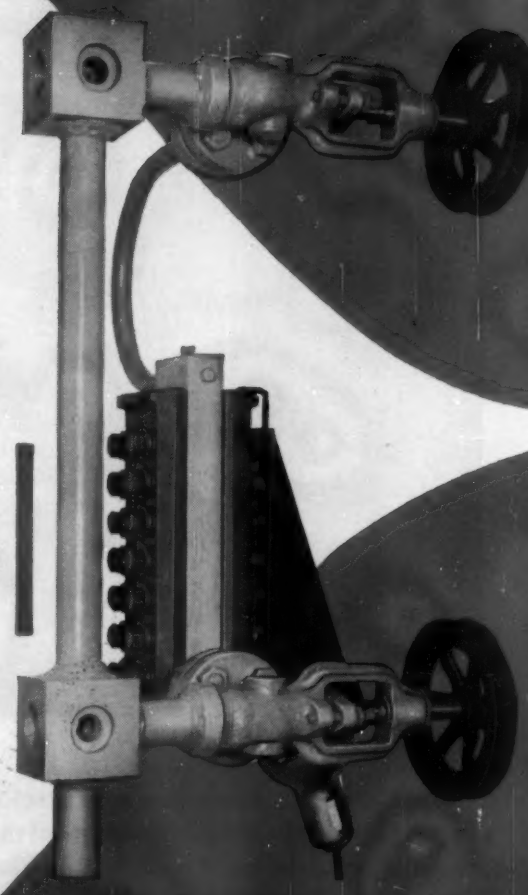
Write now for new YARWAY Bulletin WG-1812.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES



YARWAY Flat-Glass Water Gage Assembly with four-glass double insert for long ranges of visibilities.

Note separated design, interconnecting expansion loops, flanged connections (1½" tie-bar-type circulating water column) and Type "M" Illuminators that make meniscus at water level "shine like a star".



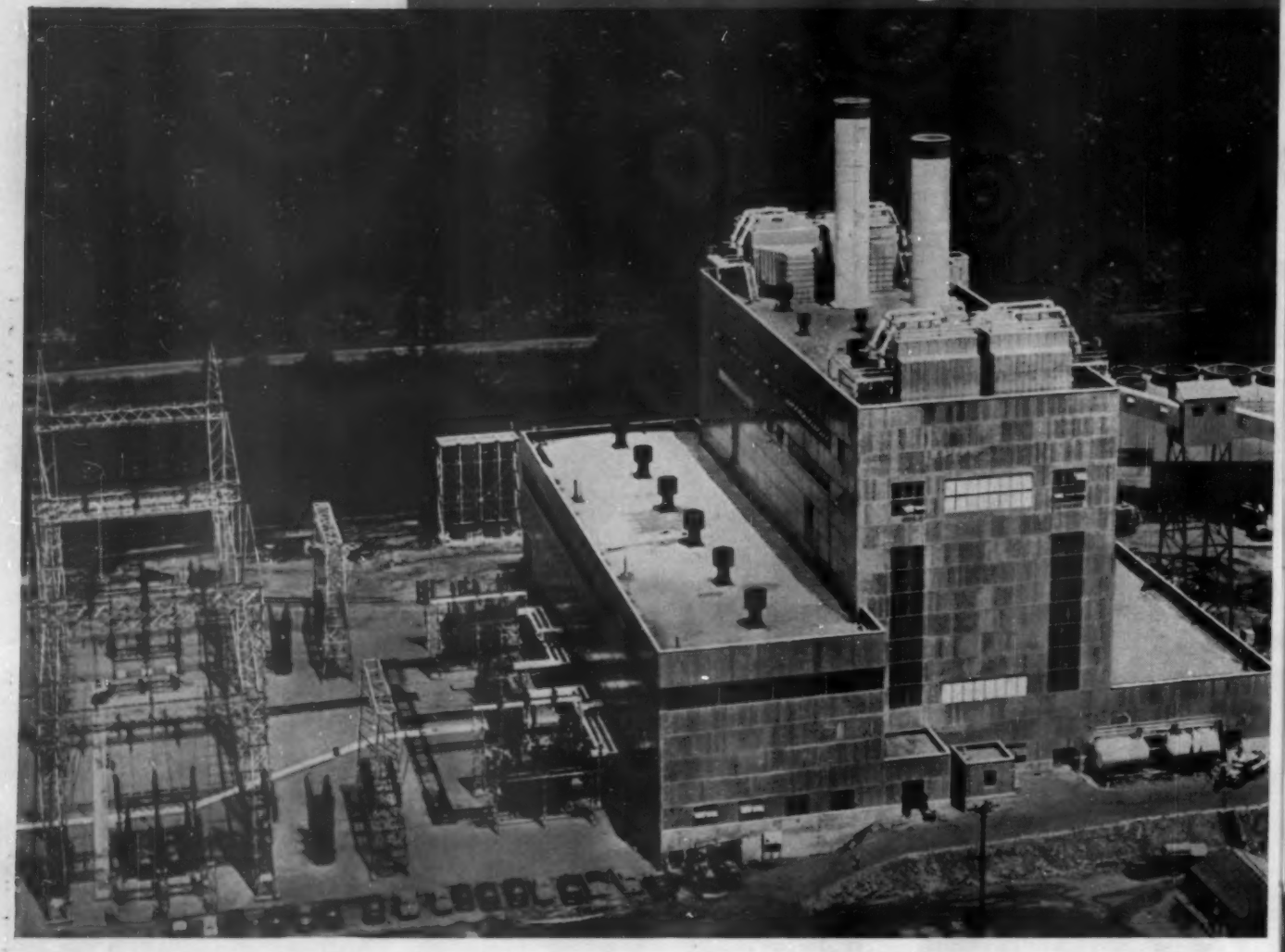
YARWAY Single Insert type gage for medium range of visibilities. Note expansion loop and flanged connections. YARWAY Welbond Gage Valves assure highest dependability in high-pressure service.

Close-up of YARWAY Type "M" Illuminators on above 4-glass insert assembly. The blue-white illumination is visible for distances up to 125 ft. and is especially effective in penetrating deposits on gage glasses, dust particles in the air and extraneous light.

YARWAY

water columns and gages

2 B&W Boilers Make Major Contribution to efficiency and

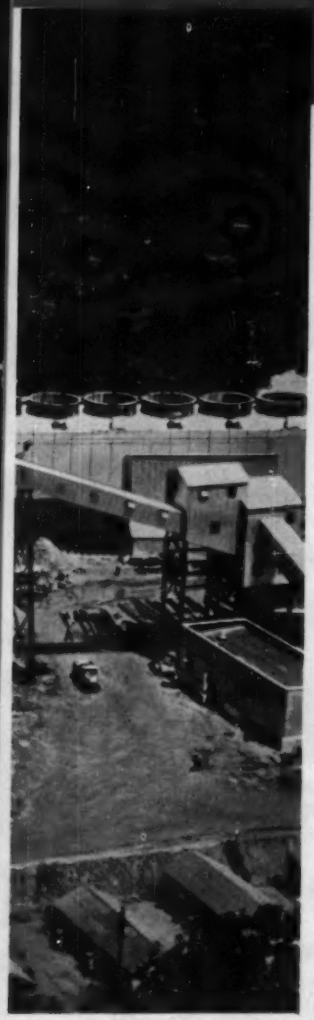


Utilizing design improvements developed to increase power generation efficiency and raise the level of unit availability, Pennsylvania Electric Company's new Shawville Station truly typifies power progress while demonstrating Penelec's awareness of future requirements in the area it serves. Currently operating as a two-unit plant, Shawville Station will eventually be expanded to 4 units and have a capacity totalling more than 500,000 kw.

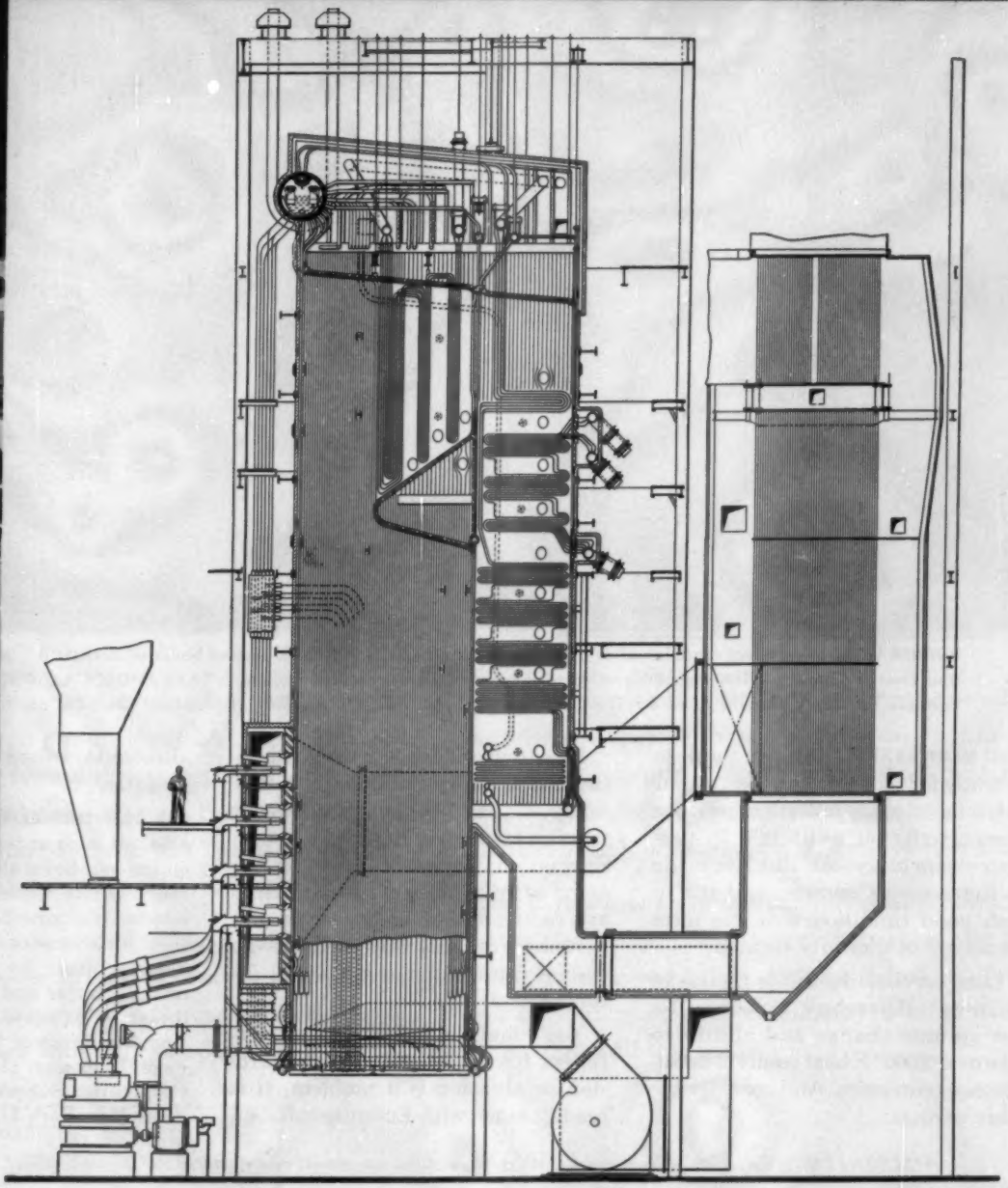
Another addition in General Public Utilities' expansion program, Shawville Station is situated in coal fields near the center of Penelec's system load. Its two identical B&W Radiant Reheat Boilers have a design pressure of 2080 psi and a combined steam capacity of 1,788,000 lb per hr. These units include B&W Cyclone Steam Separators for natural circulation and each is equipped with 16 burners served by 4 B&W Pulverizers. This installation also includes B&W tubular airheaters and B&W continuous-tube type economizers.

Modern in every sense, Shawville Station has already demonstrated its efficiency during the first months of operation. It is one more practical tribute to the unending efforts of progressive electric companies, consulting engineers and B&W boiler experts working cooperatively to further advance the science of steam-electric power generation.

high availability
at SHAWVILLE STATION



Shawville Station of the Pennsylvania Electric Company. Engineering design and construction supervisory services by Gilbert Associates, Inc.



One of two identical, dry-bottom B&W Radiant Boilers now supplying steam at Shawville. Steam capacity is 894,000 lb per hr per unit. Steam pressure is 1900 psi at the superheater outlet and temperature is 1055 F with reheat to 1005 F.

BABCOCK & WILCOX

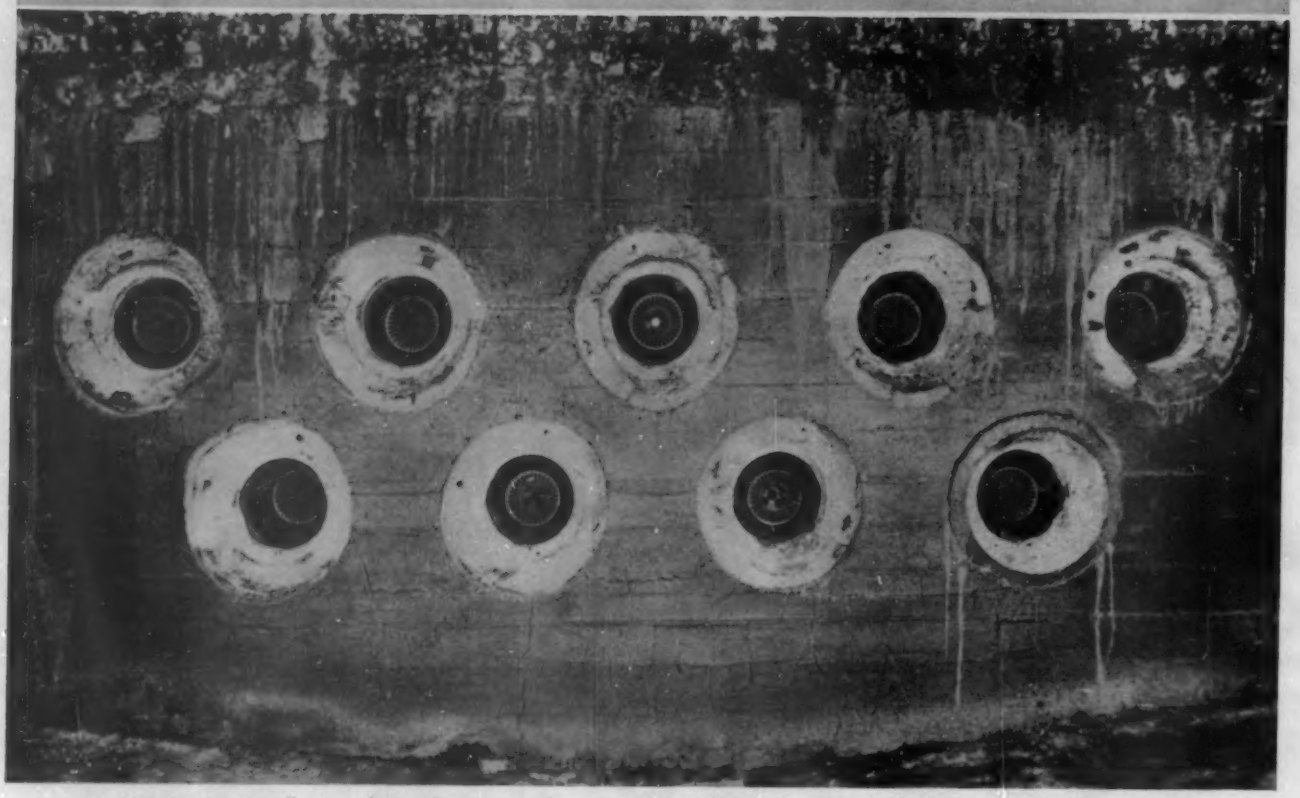
BOILER DIVISION

G-687

For more data circle 527 on Post Card

Longer-lasting boiler wall quickly made with...

REFRACTORY CONCRETE



BURNER WALL in excellent condition after a year of service in a 100,000 lb./hr. steam boiler at station "B," San Diego Gas and Electric Company. This monolithic refractory concrete burner wall is made with TASIL HYDROCAST #401, a 3000°F. castable refractory manufactured by The Chas. Taylor Sons Co. (A Subsidiary of National Lead Co.), Cincinnati, Ohio.

YOU MIGHT EXPECT this front wall to be ready for replacement. Over a year old, it has already outlasted previous burner walls on a 100,000 lb.-per-hour steam generator. But it is made of Refractory Concrete, and it's in such good condition that the form marks are still clearly defined.

Long service like this is typical of Lumnite* Refractory Concrete. Its low volume change and ability to take over 2600°F. heat result in maintenance economies. And consider the other savings:

Less time and labor are needed because Refractory Concrete is placed easily as a monolithic unit...reaches service strength within 24 hours. Special shapes can be cast on demand so inventories of special shapes are reduced. For instance, burner ports here are cast with the base—no special shapes and complicated fitting needed.

You'll find Refractory Concrete excellent for use wherever heat, corrosion or abrasion is a problem. It is readily made with Lumnite calcium-aluminate cement and refractory aggregates.

FOR CONVENIENCE, use a prepared castable mix such as the one that was used on the job shown above. Most castables are Lumnite Cement plus aggregates selected for specific temperature and insulation service – add only water. They're made by leading refractory manufacturers and sold through their dealers. For more information, write Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

**"LUMNITE" is the registered trade-mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

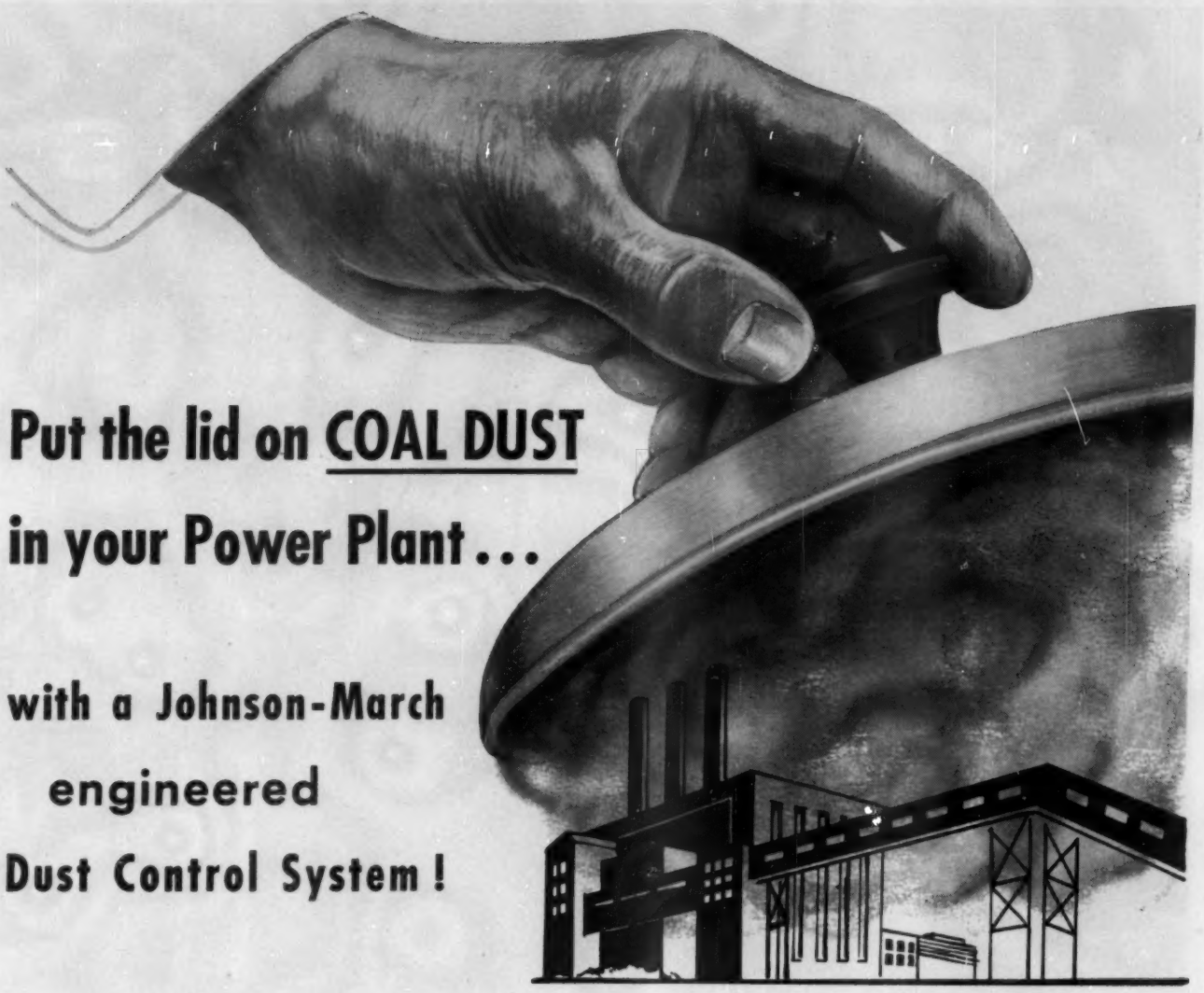
PE-L-58

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station

For more data circle 507 on Post Card



Put the lid on COAL DUST in your Power Plant...

with a Johnson-March engineered Dust Control System!

Here's the simplest, most economical way you can stop dust in your power plant. A Johnson-March engineered dust control system stops coal dust wherever it occurs—at car dumpers, crushers, hoppers, belt galleries and coal piles... as well as dust created in fly ash handling and disposal.

Low-cost liquid dust control systems require almost no maintenance—cost only 1/10 as much as most other dust handling systems. No costly ducts, hoods or fans to interfere with normal operations.

Join the many leading power plants that have solved maintenance problems due to coal dust... fire and explosion hazards... community dust nuisance problems... safety hazards... with economical Johnson-March engineered dust control systems.

Even if you now have a mechanical dust collection system, let Johnson-March engineers show you how it can be improved at low cost. For a fast, sure solution to your plant and community dust problems, fill in and mail this coupon today.

THE JOHNSON-MARCH CORP. PE
1724 Chestnut St., Philadelphia 3, Pa.

At no obligation, please

- ☐ Send informative data on J-M dust control systems.
- ☐ Have an engineer analyze our dust problem at no obligation.

NAME..... TITLE.....
COMPANY.....
ADDRESS.....
CITY..... STATE.....

Johnson March

Dust Control Engineers

1724 CHESTNUT STREET, PHILADELPHIA 3, PA.

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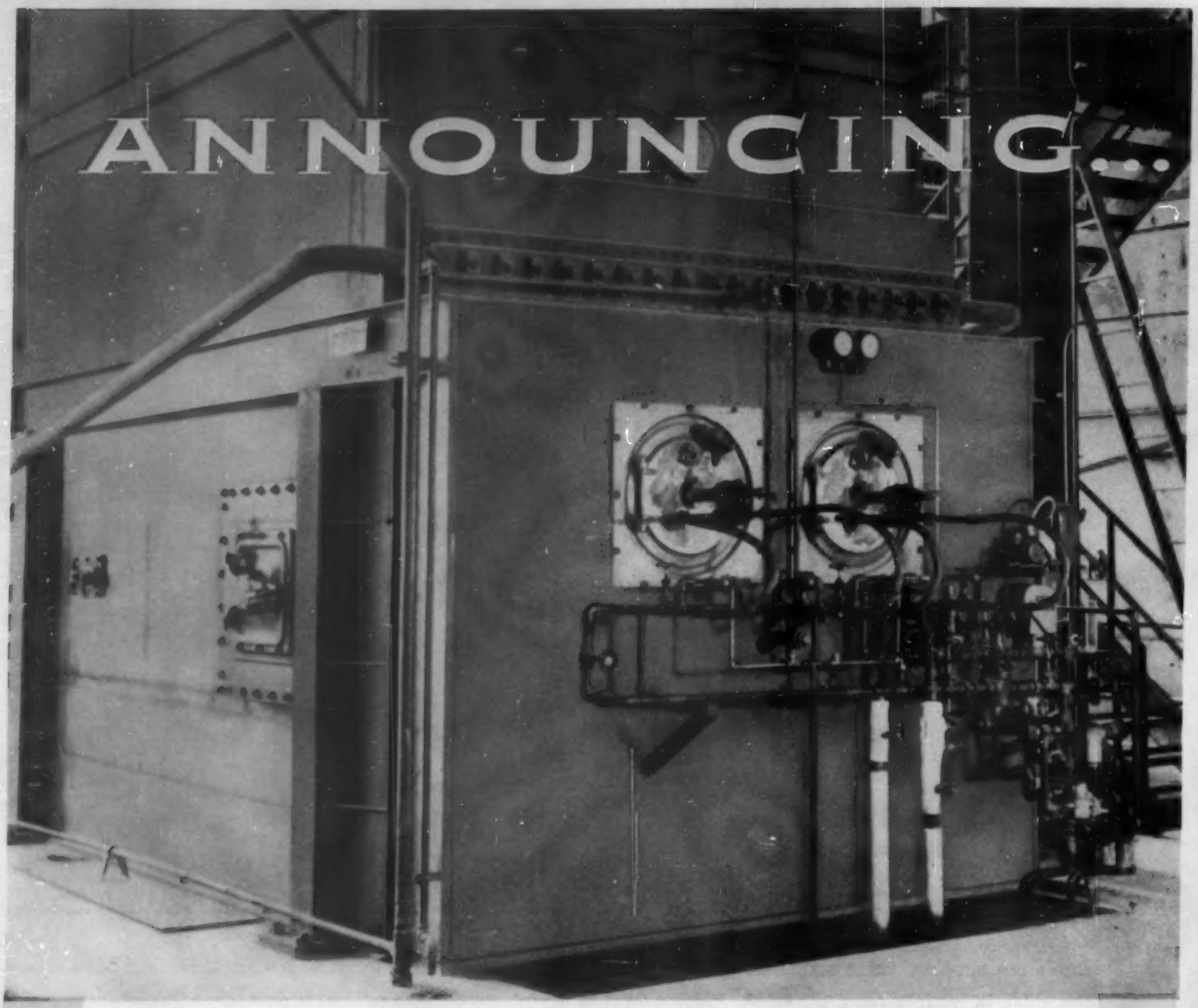


High-Temperature (H-T) Water has important advantages over Steam for Heating or Process. Here's Why . . .

HIGHER AVAILABLE HEATS are on tap. Many more Btu's are in a cubic foot of H-T water than in a cubic foot of steam at the same pressure. The greater storage volume, full of a higher Btu-carrying fluid, gives a heat reservoir from 40 to 100 times that of an equivalent steam system.

UNIFORM TEMPERATURE CONDITIONS prevail at all loads because water is circulated throughout the system under positive controlled pressure. In process plants, you can isolate special equipment for very fine temperature control, to produce a better product.

CLOSE CONTROL OF TEMPERATURE can be maintained either at the boiler or at individual pieces of equipment. Since temperature in the H-T water system need not be a direct function of system pressure, moderate adjustment does not affect boiler operation.

SIMPLIFIED BOILER OPERATION is a result of the system's inherent heat reservoir. This permits use of automatic controls of proved reliability.

HEAT LOSS IS MINOR since H-T water systems are usually fully closed, constantly circulating water back to the boiler with no condensate losses. Thus, heat not used in process or heating returns to the boiler. This represents a fuel saving of 10-20% ...one that's more apparent the longer you operate the boiler.

NO ELABORATE FEEDWATER TREATMENT is needed. Since most H-T water systems are closed, full of water and free from air spaces, makeup requirements are a few gallons a day at most. Furthermore, there can be no active corrosion resulting from air-contact of wetted surfaces. These add up to substantially lower operating and maintenance expenses.

NO STEAM TRAPS which means the elimination of trap problems, maintenance costs and heat losses.

NO PIPING GRADIENTS are required, because there is no condensate drainage to consider. What's more, since the H-T water is under positive pressure, there is maximum flexibility in the arrangement of heating circuits.

The C-E La Mont Controlled Circulation Hot Water Boiler

for large heating and process applications

Combustion's high-temperature (H-T) water boiler is especially designed to utilize the inherent advantages of hot water over steam (see opposite page) for large central heating installations and for many process applications. Units are available in sizes from 10,000,000 Btu per hour up, for any fuel, with pressures up to 300 psi and water temperatures to about 425 F. The chief advantages of the C-E La MONT *Controlled Circulation* Hot Water Boiler are:

Complete control — System control over the H-T water movement is extended to the boiler at all heat rates, since the water is under positive, controlled pressure.

Low pressure loss — Because of the low pressure loss inherent in the design, the system circulating pumps can be used to provide circulation through the boiler.

Pressurized operation — Used with oil or gas fired boilers, pressurized operation permits a simple stack arrangement and eliminates the need for induced draft fans.

Single-pass design — Absence of baffles not only assures low draft loss but also a cleaner boiler since there are no dead areas where deposits are likely to accumulate.

High furnace heat rates — The close spacing of furnace wall tubes offers greater wall protection, permits high heat rates in the furnace with low maintenance.

More efficient heat transfer — Since the water is positively circulated through the heating circuits, these circuits may be proportioned and arranged for maximum efficiency.

Lighter boiler weight — Less surface is needed because heating surfaces are more efficient. With closely spaced wall tubes, setting thickness is reduced.

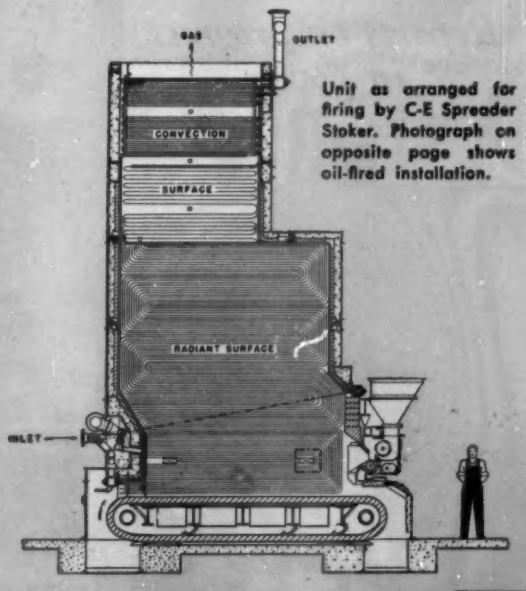
Any fuel — Boilers can be arranged for oil or gas burners, or spreader stokers. Special designs using other types of firing or waste heat are also available.

Other design features — All boiler tubes are completely drainable and ventable—small number of headers all accessible from outside of casing — completely steel-enclosed setting.

If you have a heating or process job that's suitable for high-temperature water, it will pay you to look into a C-E La Mont installation. As compared to steam, it will give you a simpler and less expensive distribution system and lower fuel and maintenance costs, plus the specific advantages described at left. Write for further information.

TYPICAL APPLICATIONS OF H-T WATER

Space Heating	Heating Platens
Ovens	Hot Tables
Tanks	Snow Melting Coils
Kettles	Cafeteria and
Calendar Rolls	Kitchen Apparatus



Unit as arranged for firing by C-E Spreader Stoker. Photograph on opposite page shows oil-fired installation.

B-806C

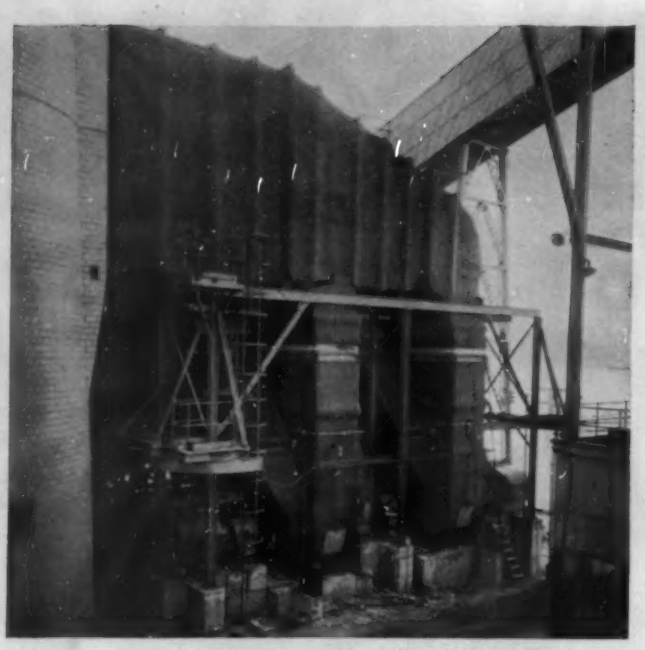
COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

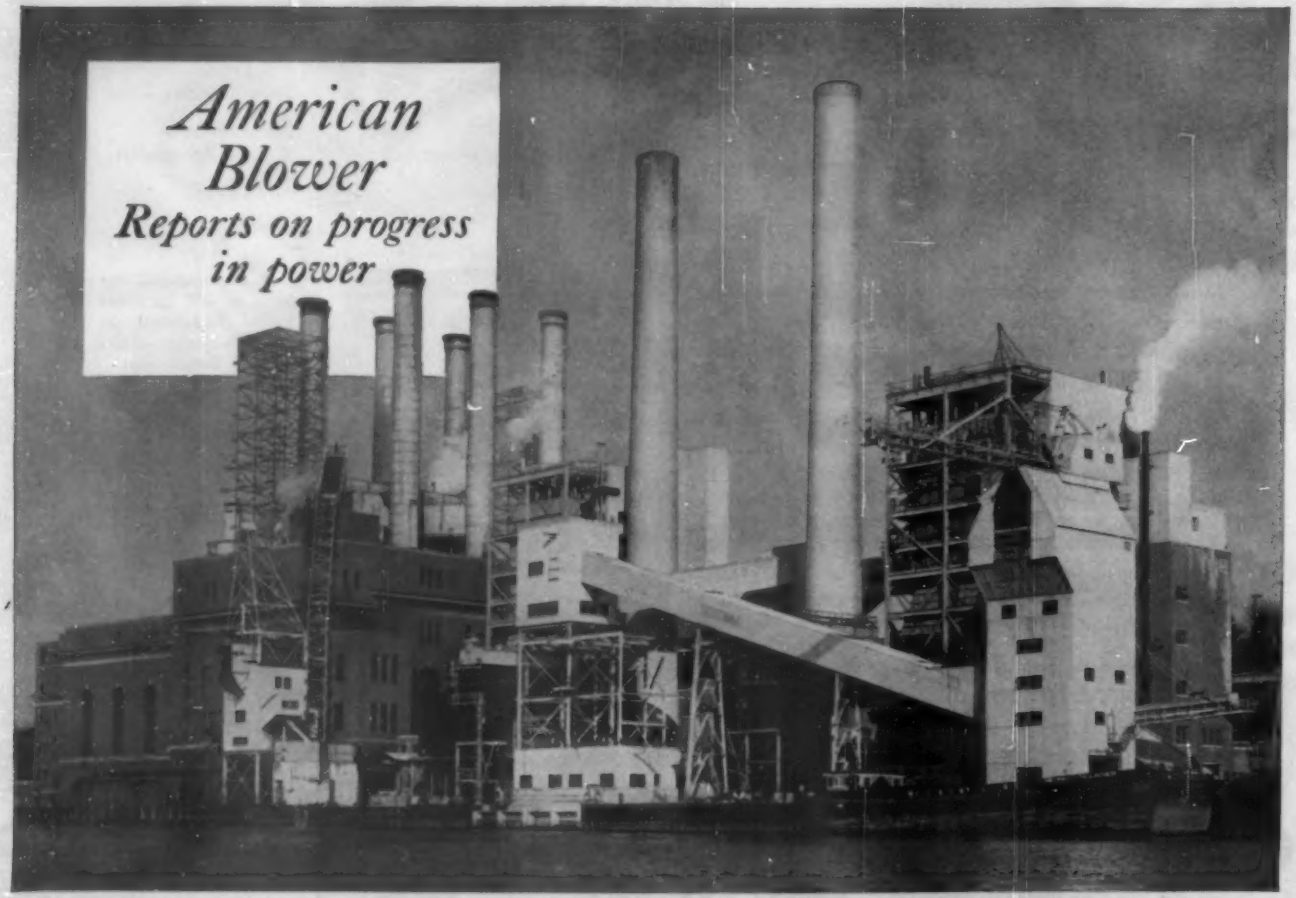
For more data circle 509 on Post Card

1. Two new units at Long Island Lighting's Glenwood Plant add 220 Mw to plant's capacity. Note outdoor turbines (foreground) – first in northeast area of U.S.

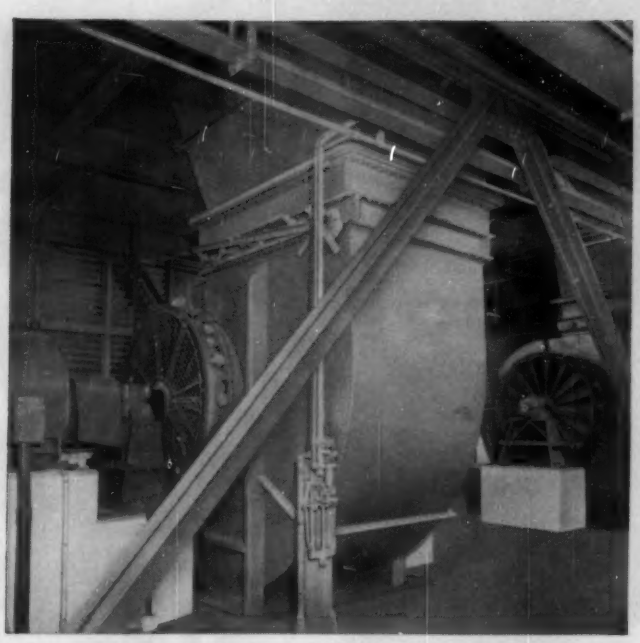


2. These two American Blower Induced Draft Fans are installed on unit #5 at Glenwood Plant. Each has capacity of 197,000 cfm @ 275°F @ 17.10 sp, @ 703 rpm.

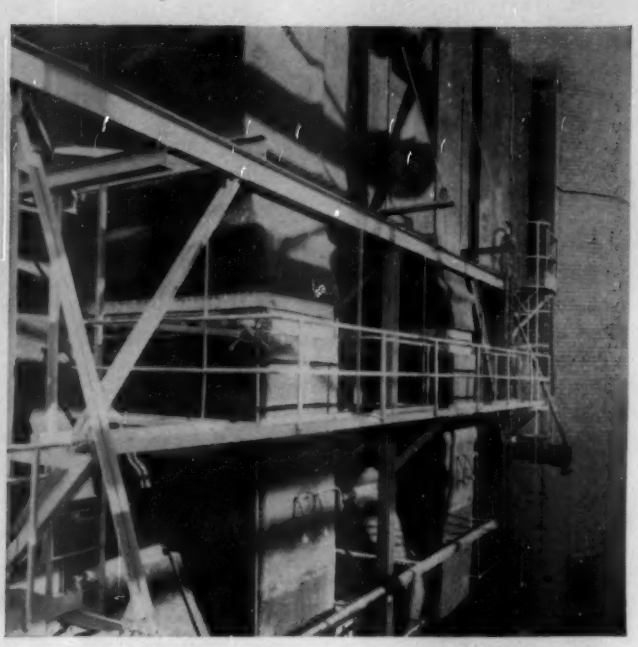
Long Island Lighting pioneers



Glenwood Plant uses American Blower Fans on six older units and new outdoor-type units (right). Long Island Lighting's other generating plants include: Port Jefferson, Far Rockaway and Edward F. Barrett stations.



3. American Blower Forced Draft Fans on Glenwood's #4 unit are each rated @ 135,000 cfm @ 100°F @ 12.75 sp, @ 875 rpm.



4. These American Blower Induced Draft Fans are installed on Glenwood's #4 unit. Each fan is rated at 197,000 cfm @ 275°F @ 17.10 sp, @ 703 rpm.

use of outdoor-type units in Northeast; operations reflect design progress!

Leading power company shows *progress in power* with new outdoor construction, reheat cycle and American Blower Fans

SINCE THE second world war, the Long Island Lighting Company has spent millions on expansion — over $150,000,000 on electrical facilities alone. Operating efficiencies have gone up.

The use of the reheat cycle and high steam pressures and temperatures have cut fuel costs. New outdoor-type generating units permitted greater flexibility and saved in construction costs. However, these new units, using American Blower Forced and Induced Draft Fans, have provided more than flexibility and savings: they are also free from objectionable noise.

When it comes to air handling equipment, leading power and industrial plants prefer American Blower equipment for its quiet, dependable operation, for indoor as well as outdoor-type installations.

Whether *your* modernization or expansion plans call for Mechanical Draft Fans, Fly Ash Precipitators, Dust Collectors, Heavy Duty Steam Coils or Gyrol Fluid Drives for boiler feed pump and fan control — profit by discussing your needs with an experienced American Blower representative. Call your American Blower Branch Office, today, or write us direct.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
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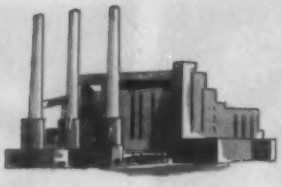
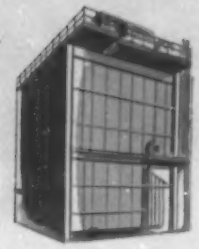
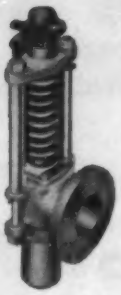
AMERICAN BLOWER

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

For more data circle 510 on Post Card

In the 267 new  central station units being started in 40 different states during the 1953-56 period, 75% of the  boilers will be equipped with  Consolidated Maxiflow Safety Valves ...35% will also have Consolidated Electromatic Relief Valves. These bulletins tell you why.

Consolidated Maxiflow Safety Valve BULLETIN 707 contains data about the greater discharge capacity, permanent tightness and easily controlled blowdown that make this valve outstanding in safety and service.

Consolidated Electromatic Relief Valve BULLETIN 720 tells how this valve assures (1) more accurately balanced boiler operation; (2) more uniform line pressure; (3) power conservation; (4) less maintenance of spring-loaded safety valves; (5) greater protection against overheating your superheater; (6) increased efficiency for your steam generating plant.

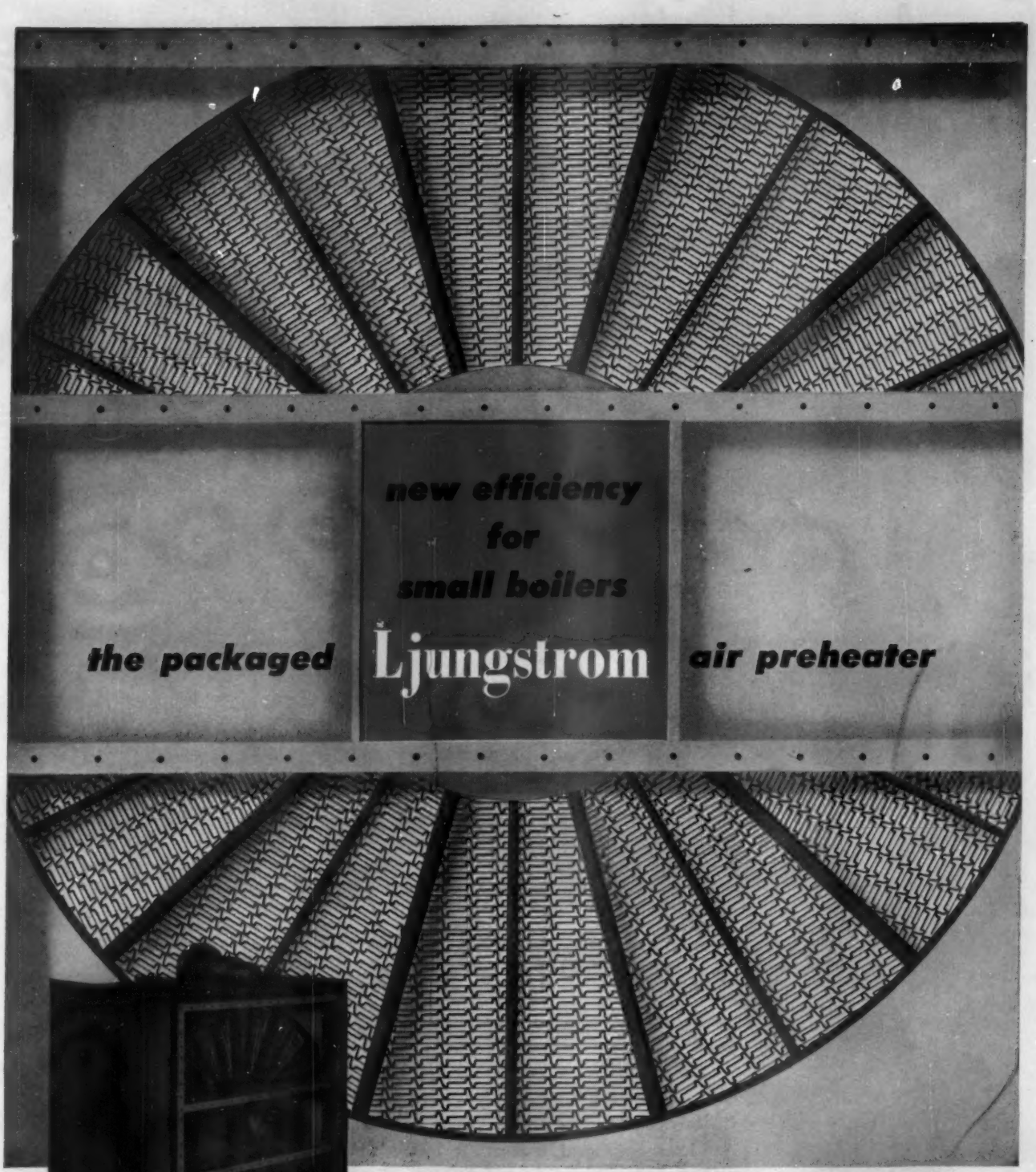
Both bulletins give complete specifications. Write for copies.

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

MAKERS OF 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' AND 'AMERICAN-MICROSEN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, AIRCRAFT PRODUCTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

For more data circle 511 on Post Card



Even boilers as small as 25,000 pounds of steam per hour — can now operate at fuel efficiencies you never dreamed of. With the new *Packaged Ljungstrom*, you can apply the principles of heat recovery universally used in large utilities. The Packaged Ljungstrom® Air Preheater operates on the *continuous regenerative counterflow* principle. Waste heat in products of combustion is absorbed on specially designed surfaces in the slowly rotating rotor. As the surfaces enter the stream of incoming combustion air, they transfer their heat to this air. The entire unit is self-contained as you receive it. For more detailed information — get in touch today with The Air Preheater Corporation.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

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Evenly matched or not...

there's enough difference to make all the difference

Before the bout, two fighters may look equally good to the fans. After a round or two, the differences begin to show up.

It's the same with heat exchanger tubes. They all start out looking pretty much alike, but under the test of day-in, day-out operation, Scovill Phosphorized Admiralty Heat Exchanger Tubes have consistently shown superior performance.

Hot-extrusion from Scovill Continuous-Cast billets means uniformity in the metal, uniformity of chemical composition and grain structure, uniformly high phosphorus content. It means sounder metal—smooth, dense, free from pits or porosity. These—plus Scovill's unrivaled Technical Application Services—are, indeed, differences that make *all* the difference in economical, uninterrupted service under tough operating conditions. Let us tell you more about them.

Scovill Manufacturing Company, Mill Products Division, 99 Mill Street, Waterbury 20, Connecticut. Phone PLaza 4-1171.

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HEAT EXCHANGER TUBE

Phosphorized Admiralty • Admiralty • Arsenical Admiralty • Muntz Metal • Naval Brass • Red Brass, 85% • Deoxidized Copper
Arsenical Copper • Copper Nickel, 10% & 20% • Cupro Nickel, 30% • Aluminum Brass • Aluminum Bronze, 5% • Duplex Tube

38C53

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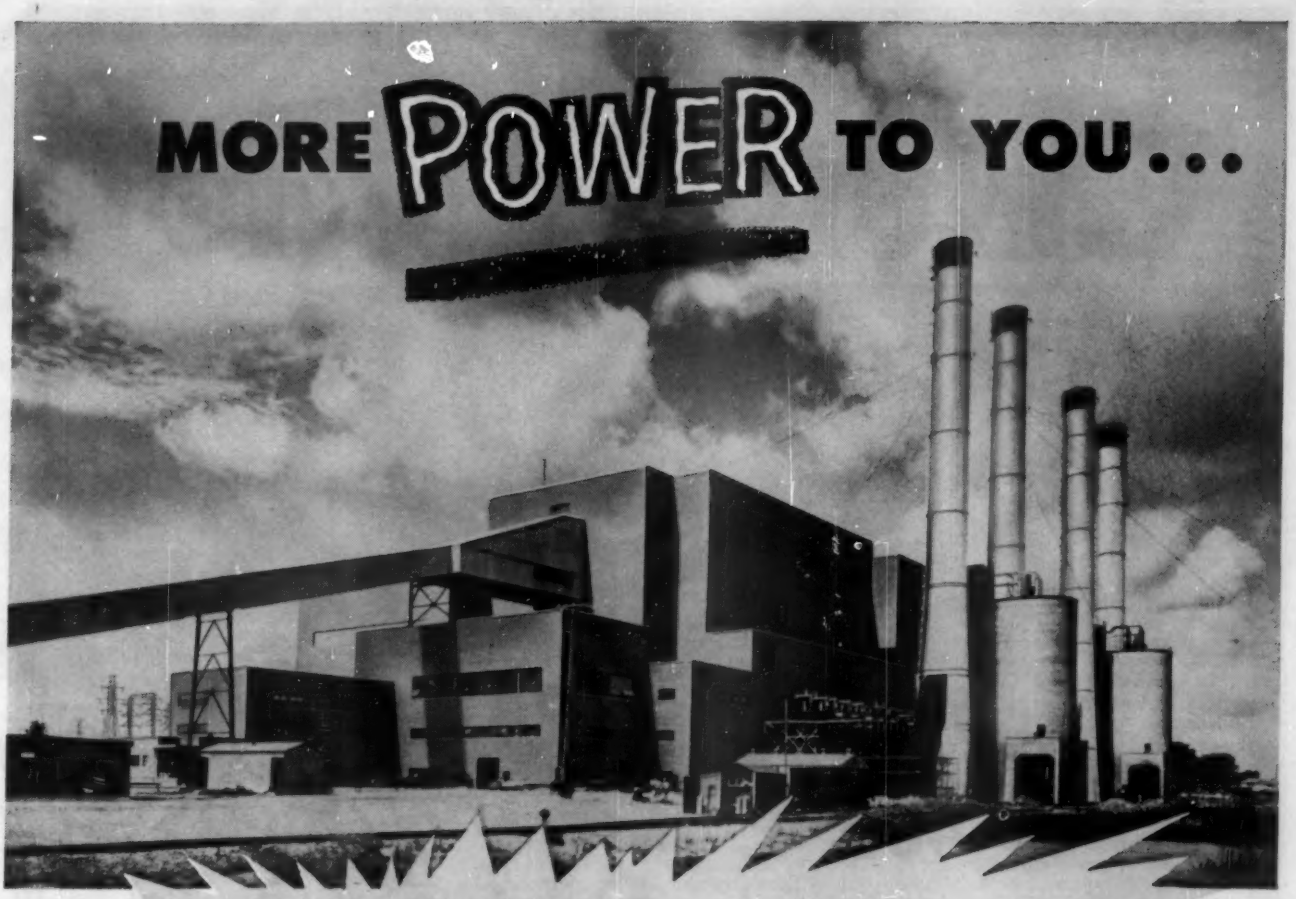

Detroit Edison Plant boosts U.S. Electrical Capacity to 100,000,000 KW.

Detroit Edison's St. Clair plant boosts U. S. generating capacity to a new high. The latest St. Clair unit, rated at 156,250 kw., to go on the line brought the total U. S. electrical capacity to over 100 million kw. Shell Turbo Oil 27 was purchased as the lubricant for this unit as well as for the other three turbine generators in this plant.

Shell Oil Company extends heartiest congratulations to Detroit Edison Company for their part in achieving this industry milestone in electrical power.

Shell is proud of its long association with the great electrical industry.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

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JACK FROST

at 406° F.

MAGNIFIED fifty times, the calcium carbonate scale in the photo above might easily be mistaken for a frosted window pane. It was formed at 250 p.s.i. in one of the Nalco Laboratories' test boilers as a part of the continuing Nalco research program, aimed at keeping such scales *out* of your power plant equipment.

Whether your feedwater and plant conditions produce this type of scale — or any of hundreds of others — your Nalco Representative has the proved solution for eliminating scale or corrosion from raw water inlet to and through condensate return lines . . . permanently . . . economically. Check with him today — or write direct for fast action on your water treatment problems.

DO YOU RECEIVE "Nalco ABSTRACTS"?

"Nalco ABSTRACTS" is a quarterly publication containing abstracts of general and technical articles of interest to power plant engineers. If you, like most of us, find too little time to read, "Nalco ABSTRACTS" can be of real help in keeping you up-to-date on current developments. Your copies will be sent free upon request.

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THE Nalco® SYSTEM...Serving Industry through Practical Applied Science

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HELPFUL BULLETINS

WATER CONDITIONING

101 Chemical Treating of Feedwater — Application Engineering Data Sheet D-54-3 discusses use of Hydrazine in treating feed water for high pressure boilers. Tells how precise addition of this chemical to boiler feed water maintains residual oxygen content at zero and also prevents ammonia accumulation in the system. Milton Roy Co.

102 Chemical Feeding System — The advantages of a systemized chemical feeding program for industrial water systems are discussed in this 6-pp folder. Examples of tube failures, plugged feed lines, and other troubles caused by ill-advised chemical feeding are presented. Hall Laboratories.

103 Steam-Jet Deaerator — Bulletin W-210-B-32, 8-pp, contains information on design improvements, ranges of application, performance characteristics, principles of operation and construction details for company's full-contact steam-jet deaerators. Cutaway views illustrate component parts and performance chart gives cc per liter of dissolved oxygen in effluent against per cent rated load. Worthington Corp.

104 Makeup Water Supplements — Supplementary treatments for boiler makeup water are discussed in Bulletin, 28 X 8226. Points out that since no external treatment system produces complete removal of objectionable materials from the makeup and contamination usually exists in condensate, further chemical or supplementary treatments are advisable. Allis-Chalmers Mfg. Co.

105 Status of Demineralizing — Six-pp Technical Reprint T-127 titled, "The Status of Demineralizing in Today's Plants," presents a comprehensive discussion on demineralization for boiler feedwater. It supplies helpful curves for estimating costs and performances of systems now available, also flow diagrams of basic types of units and the results obtainable from each. Drawings of typical regeneration systems, cutaway view of an ion exchange unit, and a table of piping and fitting materials are also included. A feature of special interest is a chart on estimated chemical operating costs for various systems. Graver Water Conditioning Co.

INSTRUMENTS AND CONTROLS

106 Guide to Instruments — Publication GL-1 summarizes company's line of indicating, recording and controlling instruments in text and photos. Covers various industrial thermometers, in ranges from −40 to 950 F., dial thermometers from −300 to 1200 F. Recorders for pressure, temperature and humidity are shown. Bulletin also covers portable running time-temperature recorders, electric recording controllers and alarms, pneumatic off-on indicating controllers, and pneumatic proportional recorders designed for 1 to 100 per cent proportional band. United States Gauge Div., American Machine and Metals, Inc.

107 Pneumatic Instruments — Catalog H-1, 12-pp, covers company's pneumatic regulators, relays and filters through descriptions, photos and diagrams. Specifications for all models are also included. Conoflow Corp.

108 Thermocouple-Air Converter — Bulletin A-714 describes a thermocouple-air converter which enables users to retain their pneumatic recording and controlling panel components and yet capitalize on advantages of company's Autronic system of all-electronic process control. Data on principles of operation and mechanical and electronic specifications, ranges are included. The Swartwout Co.

109 Oil Controls — This 8-pp condensed catalog illustrates and describes controls for vaporizing oil-burning appliances with manual and thermostatic operation. Selection chart lists 23 different basic types of constant level valves, with copy identifying the application for each. In addition, all thermostatic control accessories applicable to each valve are listed. Covers different types of accessories used to convert a manually operated heater to thermostatic operation. A-P Controls Corp.

110 Power Operators — Bulletin B-50-2, 12-pp, describes company's pneumatically positioned power operator for throttling control service. Illustrates versatility of the instrument and its many applications, including proportional control of speed changers, valves, pumps and electrical components. Conoflow Corp.

The new and revised publications reviewed on these pages offer help on many operating and maintenance problems. To order them, use the Reader Service Cards on pages 99-100

111 Pressure Pilot — Publication P-1 contains information on a new pressure pilot, a self-contained control instrument. Chief features and operation are described and interior and exterior construction is illustrated with photos. Contains data on pressure ranges, specifications, dimensions, connections, mounting, and finish. United States Gauge Div., American Machine and Metals, Inc.

112 Data on Charts — This 12-pp catalog outlines company's services in producing recording charts for standard and special instruments. It includes samples of both dial and roll types charts. The method of production of over 8000 different charts is outlined and technical information is given on requirements for special charts. Technical Charts, Inc.

113 Bin Level Control — An improved heavy duty bin level control is described in Bulletin 11-0. Points out recent changes in design and construction and the resulting advantages in operation. Schematic drawings and specifications are also included. Stephens-Adamson Mfg. Co.

VALVES, TRAPS, PIPING AND FITTINGS

114 Data on Valves — Catalog 654, 64-pp, shows company's line of needle, globe, plug, relief, and check valves. Points out recent design changes, and describes new items added to the line, including 6000 psi Lo-torq selector valves, 10,000 psi needle valves, adjustable gage snubbers, pilot operated relief valves, also plug valves with Teflon plugs designed for service from −65 to 250 F without the need for a lubricant. Complete descriptions, construction details, dimensions, specifications, and ordering instructions are given. Republic Mfg. Co.

115 Ball Float Trap — Eight-pp Bulletin 289 describes ball float traps for draining water from air, gas or steam lines or for draining light liquids from gas under pressure. Physical data and prices are given for cast semi-steel and forged steel single lever, "snap-action," compound lever and free-floating lever traps. An orifice capacity chart together with tables of maximum operating pressures on light liquids of various specific gravities help in selection. Installation diagrams are included. Armstrong Machine Works.

116 Stainless Tubing and Pipe — Fabricating and working of stainless tubing and pipe is described in this fully illustrated 36-pp bulletin. Eleven types of fabrication are described separately. Helpful hints tell how to design for economical fabrication. A basic section gives fabricating characteristics of ferritic, austenitic and certain specialty steels. Tables provide detailed information on cold bending and coiling both tubing and pipe. The Carpenter Steel Co.

117 High, Low Pressure Strainers — Bulletin 9-S, 16 pp, contains information on 15 types of strainers for high and low pressure service, including dimension and sizing charts, sectional drawings and descriptive information. Discusses application, design features, and specific operating characteristics and makes a useful reference manual for power engineers. Schutte and Koerting Co.

118 Standard, Special Bellows — Diaphlex Spring-life bellows are described in this 12-pp illustrated booklet. These flexible assemblies consist of a series of metal diaphragms joined together to form flanges; are available in standard sizes but may be custom built. Booklet discusses cantilever principle of the bellows; illustrates basic design. High pressure and low pressure types are covered in detail, also end plates. A data chart is provided. Diaphlex Div., Cook Electric Co.

HEATING

119 Hot Water Heating Systems — Catalog GK-954, 24 pp, features a line of equipment for forced hot water heating systems and chilled water cooling systems.

Nine pages are devoted to information on a complete line of circulating pumps for dozens of applications. All-bronze pumps for circulating service water and silent operating centrifugal pumps for boosting water pressures are a few of the new applications. Valves, fittings, air vents, air tanks and water heaters are also described in detail. Bell & Gossett Co.

120 Gas-Fired Heaters — Form PB1-54 describes and pictures company's Panelbloc heaters that generate infra-red rays that "heat like the sun." Discusses construction and operation of the heaters, and stresses such advantages as no air blasts, downward radiations, low maintenance. Gives specifications for the heaters which operate on any commercial gas fuel. Thermobloc Div., Prat-Daniel Corp.

121 Baseboard Convectors — Catalog 4354, 12 pp, describes Perimaheat baseboard convectors for providing a heat source around the perimeter of a room. Explains how these convectors employ basic principle of heat transfer by convection. Discusses advantages of the heaters, gives design and construction details, capacity data, roughing-in dimensions and architectural specifications. Diagrams some typical systems and describes method of installation. Young Radiator Co.

MECHANICAL POWER TRANSMISSION

122 Multi-V-Drives — Master Engineering Manual V-1400, 100-pp, features company's Multi-V-Drives, presenting a scientific and simplified method for rating V-belts. Lists each popular 60 cycle motor speed with drive selections and gives possible stock sheave combinations, as well as arc and length correction factors. Use of a simple graph to find effective diameters eliminates the new De factor for sheave diameter and ratio and saves on multiplication steps. Service factors for duty classifications are based on load requirements and hours of service. Information on products and range of stock size sheaves with bore limitations is given. Also, such factors as small diameter sheave, centrifugal force, average hours per day operation and other conditions affecting belt life are considered. Available to qualified power engineers, please state your job title. Worthington Corp.

123 Double Helical Gears — Information on specifications, construction design, testing and various applications for double helical gears is offered in 12-pp Bulletin 1958E. It also contains data on lubrication, diagrams, application charts listing dimensions in inches as well as illustrations of parts such as gear and pinion, sleeve bearings, oil bearings, oil baffles and oil pump. Worthington Corp.

ELECTRICAL EQUIPMENT

124 Distribution Transformers — Through the medium of trans-vison pages, design features of company's line of distribution transformers are revealed in 10-pp Booklet B-6403. In addition to the pictorial treatment, principal features of the single phase, 3 to 167 kva, pole type transformers are discussed in detail, and grouped conveniently in several sections — corrosion resistance, sealing, installation, operation and maintenance. Westinghouse Electric Corp.

125 Protected Transformers — How this company's protected transformers help the utility is told in 8-pp Bulletin 61B7309B. Operating advantages of the transformer, available in ratings of 3 kva through 100 kva, 2400 to 14,000 v, and mechanical data on the five type designations are also given, along with a typical load-time curve for one of the units to show how the integral breaker increases useful capacity. Allis-Chalmers Mfg. Co.

126 Industrial Solenoids — Sixteen-pp Bulletin GEA-6215 describes company's line of industrial solenoids, featuring information on product design, laboratory tests, and general application rules. Fully illustrated, bulletin contains specifications, charts, and force and current curves. A cross-reference chart equates this new line with corresponding models in the former line, and shows model to be chosen for given requirements of force and stroke. General Electric Co.

127 Circuit Breakers — Design features, operator mechanism, ratings, dimensions, and weights of a line of power oil circuit breakers are given in this illustrated 8-pp bulletin. Points out chief advantages and includes diagrams, photos, and specifications. Allis-Chalmers Mfg. Co.

128 Improved Insulation Testing — This 28-pp booklet provides a resume of d-c overpotential testing, described as an improved insulation-testing method. Contains a detailed compilation of information on principles involved and bibliography on testing techniques. Also describes company's testers which have outputs from 30,000 to 150,000 v d-c. Beta Electric Corp.

129 Electrical Products — Catalog 600, 24-pp, describes company's line of electrical products and wiring specialties, including adjustable and non-adjustable floor boxes, junction boxes, gang boxes and principal accessories. Full descriptions, along with photos and specifications are included. Fullman Mfg. Co.

130 Cable Support System — Bulletin 754-A describes a standard system for supporting cable. Pictures troughs, covers, connectors and fittings. Stresses versatility and safety of the system, reduced drafting room detail required, use of standard low cost components, other advantages. P-W Industries, Inc.

131 Standard Cable Trough — Sixteen-pp Bulletin 67A describes this manufacturer's standard cable trough designed to provide sturdy raceways at varying widths at different levels and in any direction. Fully illustrated with photos and dimensional drawings, bulletin shows the basic unit and gives ordering data on elbows, branches, reducers, connections, clamp brackets etc. Includes tracing templates, load data. T. J. Cope, Inc.

132 Guide to Push Buttons — Bulletin GEA-5779B, 16-pp, contains information on a complete line of oil-tight push buttons, selector switches, and accessories. Describes product features and applications, gives ordering details, as well as dimensions and outlines, and contact ratings. General Electric Co.

COOLING

133 Facts on Liquid Chillers — Advantages of company's packaged liquid chillers are outlined in 16-pp Bulletin C-1100-B52. Pictorially and graphically illustrated, the bulletin gives specifications, dimensions and applications of variously sized liquid chillers. It also contains a number of charts listing physical data. Worthington Corp.

134 Cooling Towers — Mechanical draft cooling towers for air conditioning and small industrial applications are described in this illustrated bulletin. Points out advantages, design and construction features, includes capacity table and sectional drawing. J. F. Pritchard & Co.

135 Cooling Tower Fans — Bulletin A-111A, 8-pp, offers details on cooling tower and heat exchanger fans. Features include specifications and construction details on the tapered-blade design of plastic fans in 14- to 22-ft diameters and on a new line of plastic-impregnated wood fan blades. Other lines described include 10- to 14-ft molded plastic fans and 40- to 120-in. all-aluminum adjustable pitch fans. Hartzell Propeller Fan Co.

PUMPS, COMPRESSORS

136 Two-Stage Pumps — This 12-pp bulletin covers two-stage pumps for small power plants and high pressure boiler feed service. Contains full specifications and many photos and diagrams illustrating pump design and construction. Roy E. Roth Co.

137 Steam Jet Vacuum Pumps — High vacuum gas handling without moving parts are features of the single stage steam jet vacuum pumps described in 8-pp Bulletin 5-E. Discusses application, construction, and operation of the equipment, and includes performance data and sizing tables. Operating instructions are included as well as numerous applications of interest to chemical, food and allied processing industries. Pumps described range in maximum air load capacities from 1.7 to 8650 lb per hr. Schutte and Koerting Co.

138 Pumps For Oil Recovery — A new series of high pressure, high volume pumps for oil recovery and industrial service is described in 8-pp Bulletin 543. Points out design and construction features, lists advantages and offers application suggestions. Full specifications, performance curves, outline drawings and dimensions included. Ajax Iron Works.

139 Horizontal Compressors — Bulletin 201-C, 20-pp, outlines advantages and applications for company's heavy duty horizontal single-stage compressors. Design and construction details are described through text and photos and full specifications are included. Pennsylvania Pump and Compressor Co.

140 Gas Engine Driven Compressors — A new two-cycle turbocharged compressor is described in 24-pp Bulletin 134. Stresses economy of installation and operation afforded by this gas-engine driven unit, lists other advantages. Explains how turbocharging saves on fuel and cooling. Design and construction features of this new model are discussed and illustrated in detail; and dimensions and specifications are provided. Clark Bros. Co.

WASTE TREATMENT

141 For Water, Sewage Treatment — Bulletin 35-D, 20-pp, describes equipment for water, sewage and industrial waste treatment. Shows details of construction and specifications for circular clarifiers, to 200-ft diameter, and rectangular clarifiers with crane type scraping mecha-

Rugged, lightweight 6' sections are amazingly easy to handle.

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GUSTIN-BACON SNAP*ON

Recently, more than a mile of large 250° pipe was insulated at an eastern refinery in record time and at unprecedented low cost. The key to the success of the installation was revolutionary G-B Snap*On pipe insulation—one-piece molded cylinders of fine glass fibers.

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nism. Also describes digesters and automatic backwash sand filters. Discusses municipal sewage treatment, municipal and industrial water treatment, and industrial liquid waste treatment, connected with coal washeries, steel plants, paper plants, oil refineries. Hardinge Co., Inc.

142 Flotation System — Bulletin 54-82, 20-pp, describes company's mechanical process used to separate greases, chemical flocs, and suspended organic matter from industrial waste liquids. Illustrates details of system through the use of plan views, diagrams, photos and text. Chain Belt Co.

143 Chlorine Gas Feeders — Twelve-pp Reprint 840-L29 discusses principles of chlorine gas feeders. In addition to basic feeder information, bulletin contains special reference to applications of chlorine in the treatment of industrial waste. Numerous photos, diagrams, tables, and flow sheets are used to illustrate the subject matter. Builders-Providence, Inc.

OTHER EQUIPMENT

144 Compact Boilers — Fintube boilers designed to offer greater capacity and efficiency in less space are introduced in 6-pp Bulletin 542. Discusses internally finned tubing utilized in the boilers, and explains how this tubing assures efficient steaming. Provides capacities and dimensions on 30-, 60- and 100-hp models. Brown Fintube Co.

145 Wrenchless Chuck — This illustrated folder announces a new power grip wrenchless chuck and describes results of field tests made prior to marketing. Explains adaptation of the pipe wrench gripping principle — a distinct feature of the chuck. Also stresses smoother operation. Beaver Pipe Tools, Inc.

Postage-free cards for ordering catalogs are on pages 99-100. You may also use the cards to ask for further information on the advertised products.

146 Colloidal Dispersions — How colloidal dispersions have been used successfully for dry-film lubrication is described in illustrated Bulletin 438. Various combinations of lubricating solids and carriers and their specific application in machine lubrication, metal working, and foundry operations are presented in the bulletin. Acheson Colloids Co.

147 Titanium Tubing — Properties, applications and advantages of titanium tubing are outlined in 8-pp Bulletin 43. Presents up-to-date information on the fabrication of unalloyed titanium tubing, including such subjects as heat treating, pickling, welding, brazing, and machining. Lists applications and advantages and gives details on titanium's behavior with many reagents. Superior Tube Co.

148 Industrial Television Housings — Catalog E.55 describes two special housings developed for use with company's industrial television equipment. Features and specifications for the explosion proof housing and for the weatherproof housing are included in the catalog sheet. Engineering Products Div. Radio Corp. of America.

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

POWELL STEEL VALVES

FIG. 11323—1500-Pound Motor Operated Steel Pressure Seal Gate Valve

FIG. 3003 WE—Steel Gate Valve For 300 Pounds W.S.P.

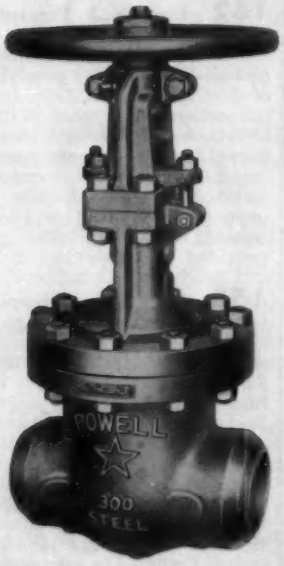

FIG. 11365—Steel Pressure Seal Horizontal Lift Check Valve For 1500 Pounds W.S.P.

FIG. 1314-A—1500-Pound Integral Bonnet Steel "Y" Valve

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Same solution after addition of 12 ppm of Bird-Archer Concentrol antifoam.

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LOW COST CHEMICAL METHOD

FOR CONTROLLING FOAM

AND BOILER WATER CARRYOVER

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A Bird-Archer 8 Point Service Engineer is as near as your phone. For friendly counsel call him or write directly to Bird-Archer outlining the details of your boiler operations.

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149 Safety Equipment — Catalog 55, 20-pp, provides complete information on company's line of safety products and equipment, as well as photos of all items. Describes various types of safety hats, first aid packs, protective hoods, and other safety equipment. E. D. Bullard Co.

. . . Outstanding Among This Month's Catalogs

150 Air Ejectors — This 12-pp newly-revised booklet describes steam jet air ejectors for efficient, low cost air removal from condensers. Well illustrated with photos and drawings, it explains ejectors' principle of operation and their classification according to stages and elements. Discusses inter-after condensers, steam jets for special services, air ejector accessories. An engineering data section covers method of determining requirements for power and process plants. Condenser Service and Engineering Co., Inc.

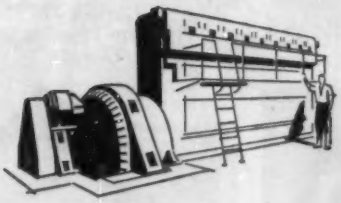
151 On Rust Prevention — Facts about company's rust preventive coating are presented in this 24-pp general catalog, featuring 98 color chips of the product and including complete instructions for surface preparation and application of primers, short oil types, long oil types, machinery and implement finishes, chemical and heat resistant types, sealers, oil field finishes, thinning oils, and floor and masonry coatings. Introduces a restful color group of finishes developed to provide color harmonies for plant interiors and machinery surfaces. Rust-Oleum Corp.

152 Electrical Precipitation — How industry uses electrical precipitators is the subject of this illustrated 28-pp bulletin. Describes general principles of electrical precipitation, and individual sections are devoted to its chief applications; power plants, iron blast furnaces, ferro-manganese furnaces, iron cupolas, open hearth furnaces, manufactured gas, oil refineries, pulp and paper, acid manufacture, carbon black, cement mills. Installation photos are provided. Research-Cottrell, Inc.

153 Properties of Super Refractories — Latest data on physical and chemical properties of this company's super refractories are featured in this 24-pp booklet. Assembled in easy to find style, the text is augmented by lists of applications together with pertinent charts and tables. Detailed information on refractories of various compositions is presented, including characteristics and fields of applications. A chemical analysis and physical properties table is included and physical properties charted. The Carborundum Co.

154 Insulation Product — Descriptions and illustrations of various types of Fiberglas Aerocor insulation are included in this 8-pp booklet. It offers a complete index to all of company's insulation products, which have a low thermal conductivity and high sound absorption qualities yet are light in weight, non-combustible, clean. Owens-Corning Fiberglas Corp.

155 Gas Turbines — Combustion gas turbines for power generation and mechanical drive are described in 28-pp revised Bulletin GEA-5516B. Gas turbine-steam



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Sinclair Lubrication Engineer Harry Donovan reports, "These units were operating around the clock under conditions *so dusty that headlights were required.* Crankcases had to be drained and flushed bi-weekly! My first recommendation was closer adherence to an air filter maintenance program."

Drain intervals doubled!

Mr. Donovan continues, "Further observation proved to me that excessive idling and overloading were all contributing factors to a severe sludge condition. I recommended Sinclair SUPER TENOL® – explaining that the superior quality of the base oil plus the Sinclair formulated additives would extend bearing life *while at the same time removing accumulated lacquer and sludge.* A trial period proved SUPER TENOL doubled drain intervals and eliminated flushing entirely. This company now uses Sinclair SUPER TENOL exclusively."

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SINCLAIR LUBRICANTS

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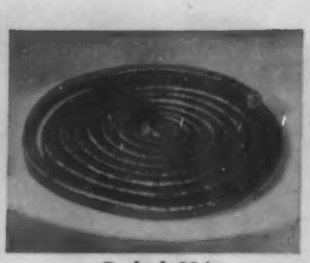
Steam Packing



Garlock 234
ROTOPAC Rotary
Pump Packing

Garlock 117
Valve Stem
Packing

Garlock 777
Low Pressure
Packing

Garlock 262
Special Hydraulic
Packing

Garlock 730
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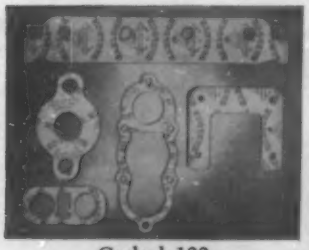
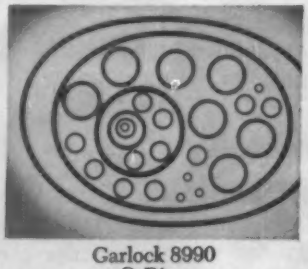


Garlock 122
Red Rubber
Gaskets



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Packings

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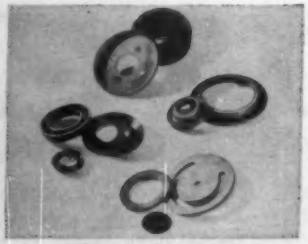
Gasket



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Garlock 631
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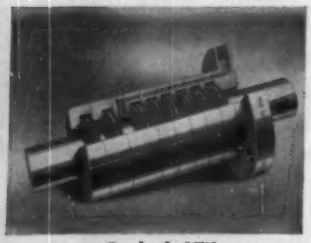

Garlock 875
Floating Metal
Packing

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turbine cycles, mechanical drive applications, design features, control and governing, generators; tables of characteristics, and dimensions and weights are among the subjects covered. Models included are simple-cycle, single-shaft; simple-cycle, two-shaft; and the regenerative-cycle, two-shaft units. General Electric Co.

156 Copper and Copper Alloy — Publication B-34, 24-pp, is a tabbed reference manual containing the latest copper and copper-alloy specifications, including ASTM, ASME, AWS, SAE, AMS, Federal, Military, and other specifications. The index is divided into two sections — the first lists company's most generally used alloys, together with the applicable specifications of the agencies, and the second section lists specifications in numeric order with a brief description of the material. The American Brass Co.

157 High Pressure Turbochargers — Six-pp Bulletin 8000 describes this manufacturer's high-pressure turbochargers and explains how they are designed to increase output 100 per cent or more. Discusses rotor construction, other design details. Photos show installations in municipal diesel plants, others. De Laval Steam Turbine Co.

158 Power Cranes in Industry — Technical Bulletin 5 is a 24-pp generously illustrated booklet on the use of free moving cranes in industrial plants. Shows their use in warehousing and outside storage, and in production handling. Various types of attachments are shown, and the advantages of the cranes are detailed. Power Crane and Shovel Assn.

159 Magnetic Pulleys — Bulletin PY-260, 8-pp, describes company's permanent magnetic pulleys, listing applications and chief features. Tells how pulleys automatically remove tramp iron from sand, slag, ore, chemicals, coal, cement, gravel, foods, and separate ferrous from nonferrous materials. Bulletin includes diagrams, performance data, specifications. The Homer Mfg. Co., Inc.

160 Automatic Chlorinizer — Bulletin 840-K13 contains information on flow responsive or automatic proportional pacing of chlorine feeders. Photos and typical installation diagrams illustrate the text, which describes several automatic pacing systems tailored to solve a variety of chlorine feeding problems. Builders-Providence, Inc.

161 Fabrication of Tanks — Catalog 554, 48-pp, describes facilities and workscope of company's fabricating plant — offering latest techniques in custom fabrication of steel and alloy plate. Particularly useful for reference purposes are the comprehensive corrosion data tables for various metals. They list the corrosive action of 200 different chemicals in various concentration forms. Nooter Corp.

162 The AB'C of School Lighting — Twenty-pp Booklet B-4556-B gives basic requirements for school lighting systems and describes lighting systems which satisfy these requirements. Discusses both new lighting and relighting projects. Tells what kind of light is needed, what lighting fixtures and how many should be installed, what plan will yield best results. Alternative lighting plans are evaluated on the basis of lighting performance, appearance, economics, and maintenance requirements. Lighting layouts are also included. Westinghouse Electric Corp.

It takes less than a quarter turn to open an Everlasting Valve *wide* or close it *tight*. That's one of the many reasons why these time-proven valves are so popular wherever quick valve action is desired . . . on equipment outlets, storage and measuring tanks, process lines, boiler blow-offs, spray lines, meter testing, etc.

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Louis V. Sutton Steam Electric Generating Plant • Carolina Power and Light Company

Temporary interruption of the flow of incoming coal can't interfere with power production at this plant . . . even though it consumes 26 carloads a day. An S-A Conveying System that keeps bunkers full and develops a million-dollar stockpile makes sure of that.

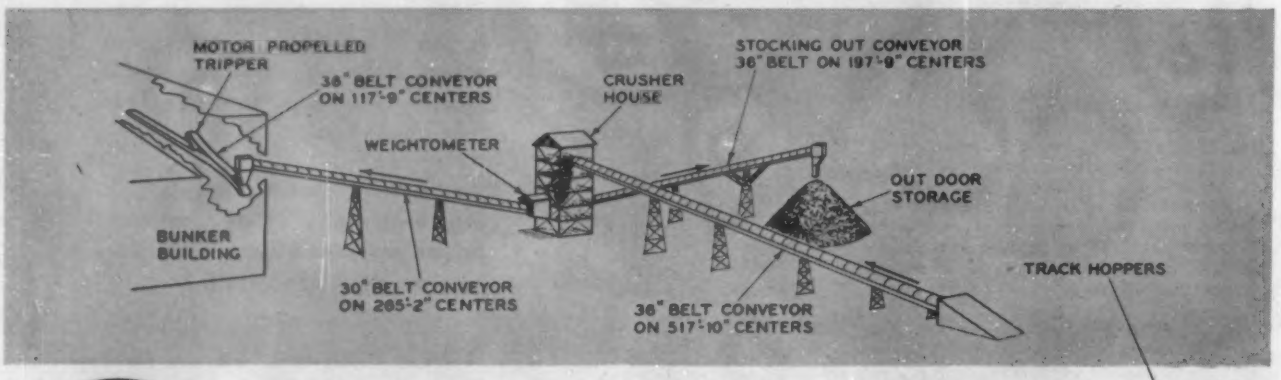
Coal arriving by rail cars is dumped into the track hopper. An S-A slope belt conveyor takes it, 450 TPH, to the "open air" crusher house. The coal is reduced to minus ¾" size in an S-A Knittel crusher that can't clog and that delivers *full capacity* even when handling wet, sodden coal.

From the crusher house, coal goes either to the stocking out conveyor or to the plant. At the storage bunkers a traveling tripper discharges through a "Zipper" bunker seal. This seal opens and closes like a slide fastener through bunker openings directly under tripper spouts, so that no dust can escape.

Coal to be stockpiled travels by a stocking out conveyor and is discharged through a telescoping spout that automatically shuts off flow when the pile reaches a predetermined height. Coal to be reclaimed is returned to track hopper by bulldozer or carry-all.

Corrugated steel hoods over all outside conveyors, and dust curtains at discharge points, effectively keep down dust. For all belts rugged, durable S-A "Simplex" carriers with spun ends and bearings protected by labyrinth seals were specified.

This is an example of the way S-A engineering can meet specific requirements for distribution, volume and clean handling. No matter how specialized your need, you'll find S-A experience and *complete equipment* offer a sound economical solution. Write us whenever we can help you.



SINCE 1901 S-A STEPHENS-ADAMSON MFG. CO.

STEPHENS-ADAMSON MFG. CO.

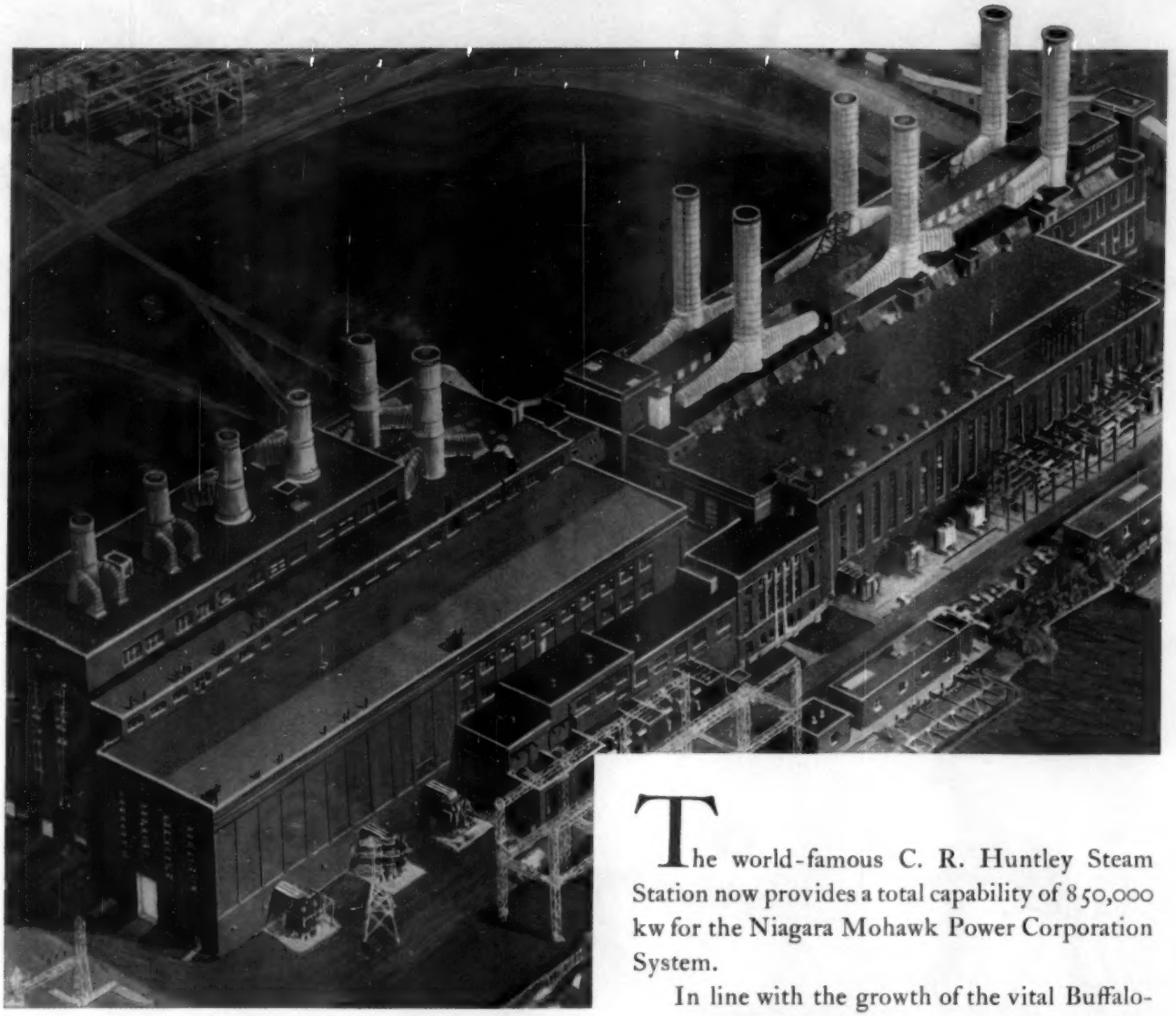
86 Ridgeway Avenue, Aurora, Illinois • Los Angeles, Calif. • Belleville, Ontario

Engineering Division
Specialists in the design and development of all types of bulk materials conveying systems.

Standard Products Division
A complete line of conveyor accessories including centrifugal loaders—car pullers—bin level controls—etc.

Sealmaster Division
A complete line of industrial ball bearing units available in both standard and special housings.

For more data circle 523 on Post Card



Two generator units, of the new hollow conductor type, each having a capability of 100,000 kw, have recently been installed at the Huntley Station on the Niagara River, near Tonawanda, N.Y.

Client SATISFACTION

The world-famous C. R. Huntley Steam Station now provides a total capability of 850,000 kw for the Niagara Mohawk Power Corporation System.

In line with the growth of the vital Buffalo-Western New York Area, Huntley—one of the largest thermal power stations in the world—has grown steadily in capacity since 1916.

The original plant was designed and constructed by Stone & Webster Engineering Corporation. The extensions of recent years have been constructed by the Engineering Corporation from designs by Niagara Mohawk's own engineers.

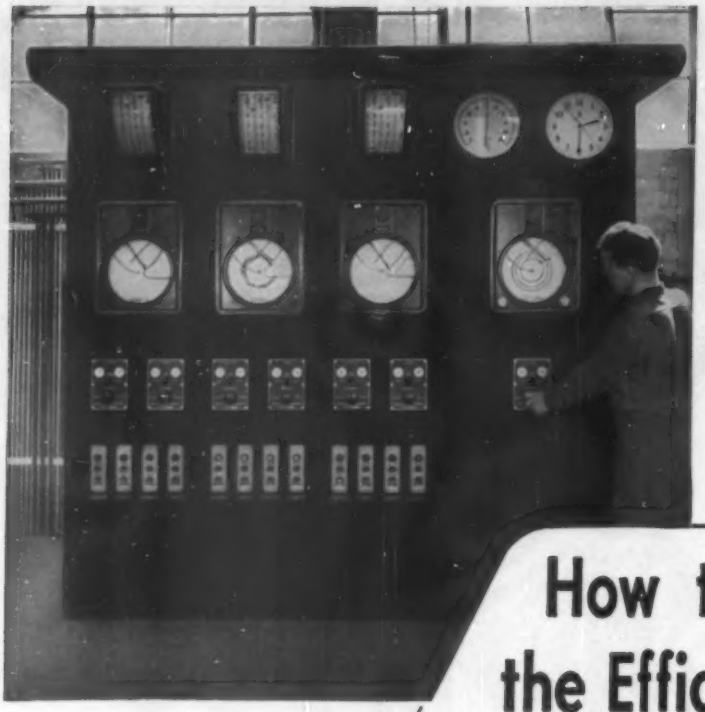
•

Write or call us for information as to how our experience may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto



These Bailey Boiler Controls at the Chicago Pneumatic Tool Company's new plant in Utica, N. Y. insure efficient operation of three 25,000 lb per hour, 100 psi, spreader stoker-fired boilers

How to INCREASE the Efficiency of YOUR BOILER-ROOM DOLLAR

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service — conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

For better "boiler-room investment" efficiency —for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

A-111-0

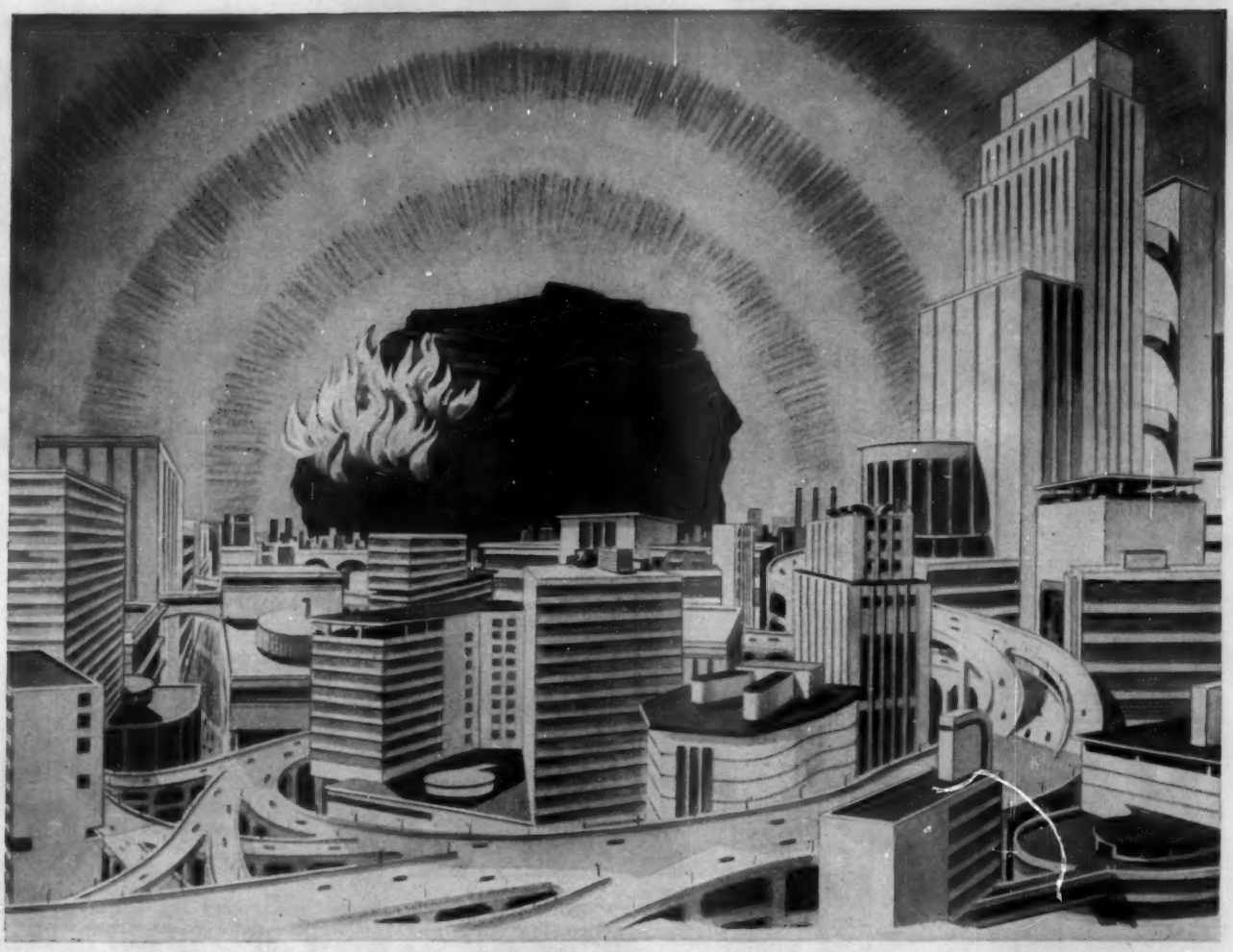
BAILEY METERS

BAILEY METER COMPANY

1040 IVANHOE ROAD
CLEVELAND 10, OHIO

Controls for Steam Plants
COMBUSTION · FEED WATER
TEMPERATURE · PRESSURE
LIQUID LEVEL · FEED PUMPS

For more data circle 525 on Post Card



The fuel that sparked our nation's growth secures her greater future

A young America—primed by a new and power-packed fuel—became a great industrial giant almost overnight. Coal had supplied the first unwavering spark which was to grow into the brightest productive flame the world has ever known.

After being served so well in the past and present, America looks again to dynamic coal for greater prosperity and security in the future. The vast Bituminous fields along the Baltimore & Ohio contain excellent coals in wide variety—available for centuries to come.

BITUMINOUS COALS FOR EVERY PURPOSE

Highly mechanized mines, equipped and ready for any demands, will help maintain long-range cost stability. And improved utilization methods will meet the increased requirements of the future by providing greater coal-burning efficiency.

CALL ON OUR COAL TECHNICAL SERVICE

You'll receive complete information from trained B&O experts about the kind and size of Bituminous coal that fits your needs best—at a price you want to pay. Write:

COAL TRAFFIC DEPARTMENT
BALTIMORE & OHIO RAILROAD
BALTIMORE 1, MARYLAND

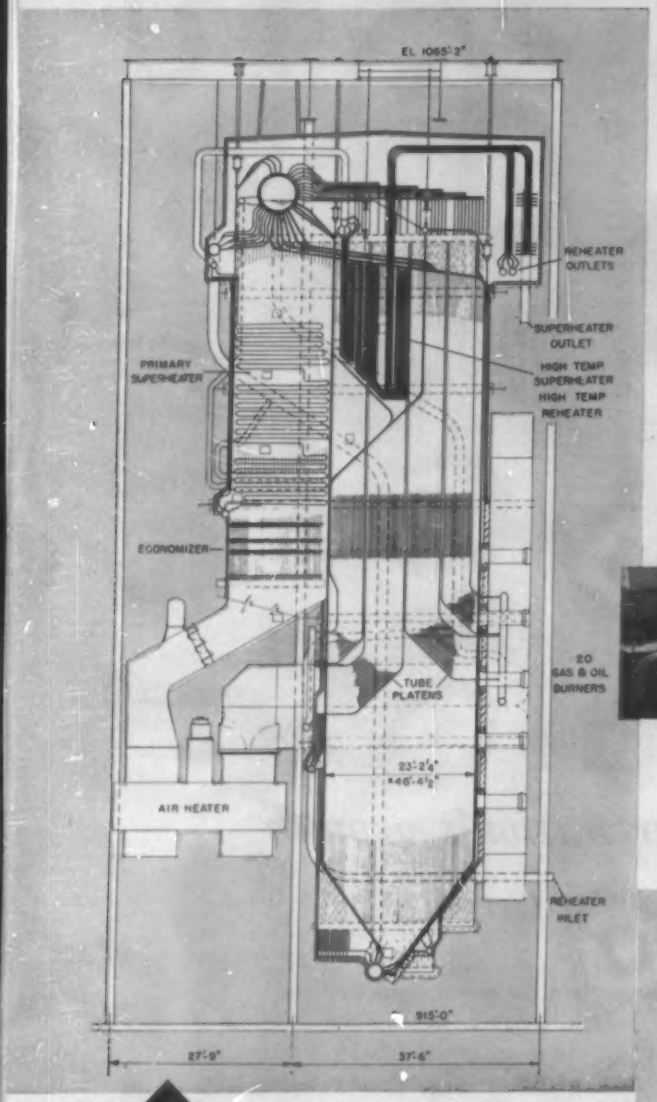
LINKING 13 GREAT STATES WITH THE NATION — B&O

Baltimore & Ohio Railroad

Constantly *doing things*—better!

For more data circle 526 on Post Card

Join the SWING to RILEY

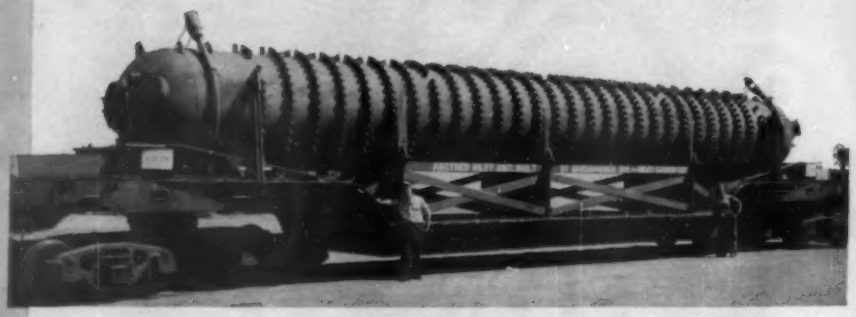


Los Angeles Department of Water & Power—Valley Steam Plant. Two 1,200,000 lbs./hr. 1850 psig. 1000F-1000F reheat. Fired by gas & oil. Riley Single Header Hopper for future conversion to Pulverized Coal. Temperature control by differential firing in divided furnaces.

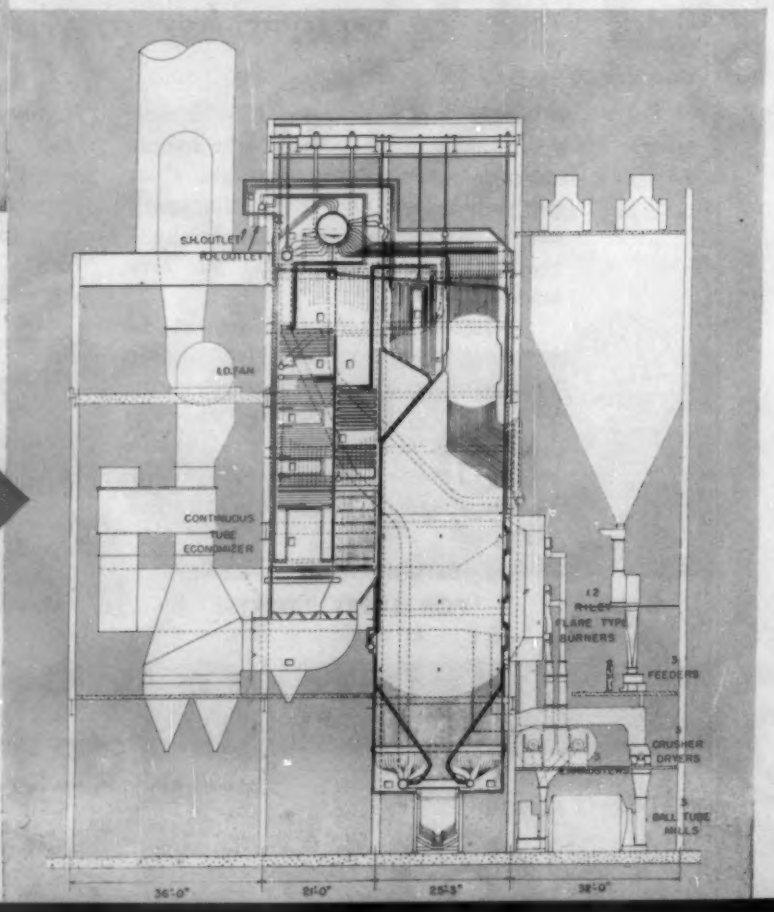
Public Service Co. of Indiana, Inc. Wabash River Station. 805,000 lbs./hr. 2075 psig design, 1005F-1005F reheat. Fired by 12 Riley Flare Type Burners, 3 Riley Pulverizers. Sargent & Lundy, Engineers.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs.

This acceptance of Riley Reheat Units by the public utilities — this marked swing to Riley has been brought about by the outstanding design characteristics of Riley reheat units — low furnace exit temperatures through the use of radiant surface preventing objectionable slag formation; wide load range with stable ignition with damper or combination of damper and spray control; high yearly net efficiency, dependability and continuity of operation.

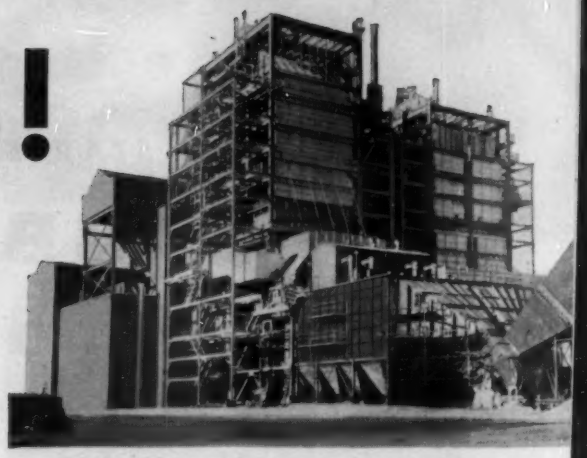


Riley designs, fabricates and erects the complete steam generating unit. Here you see the huge steam drum weighing 127 tons, 60'-0" long, 66" I.D. with 5-3/32" thick steel walls recently fabricated by Riley for one of two Riley reheat units at Los Angeles Water & Power Department's new Valley Steam Plant.

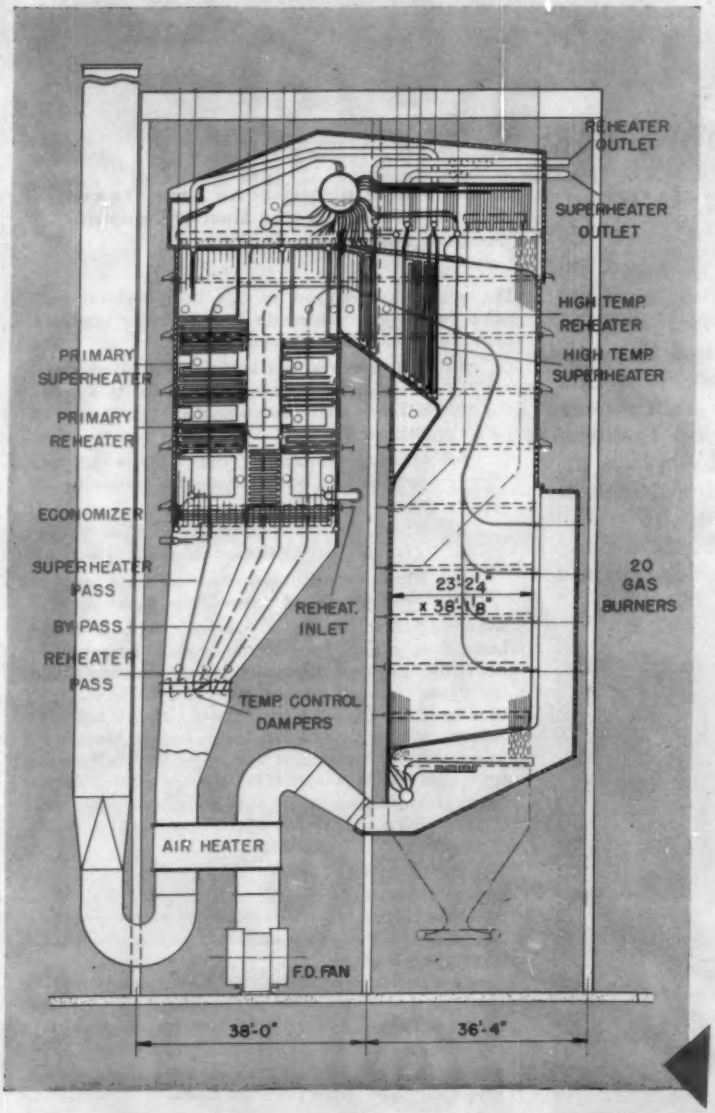


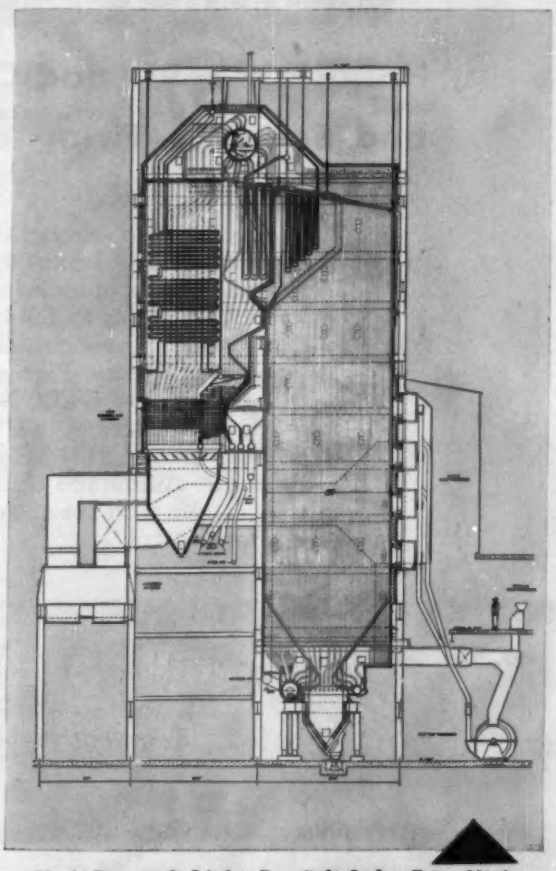
REHEAT UNITS!

a large percentage of all reheat units purchased by public utilities during 1953 were Riley units.



Completely outdoor construction is a feature of the two Riley units at Utah Power & Light Company — Gadsby Station





Utah Power & Light Co., Salt Lake City, Utah
Gadsby Station—575,000 lbs./hr. 1700 psig
1000F-1000F reheat. Riley "50" Pulverizers.
Bechtel Corporation Engineers

Louisiana Power & Light Co.—Nine Mile Point Station
1,000,000 lbs./hr. 1725 psig. 1000F-1000F reheat
Fired by gas & oil. Ebasco Services, Engineers

RILEY Stoker Corporation

WORCESTER, MASSACHUSETTS

Boston New York Philadelphia Buffalo Washington Pittsburgh Cleveland Detroit Chicago Cincinnati Charlotte New Orleans
Atlanta St. Louis Kansas City St. Paul Tulsa Houston Denver Salt Lake City Los Angeles San Francisco Portland Seattle

COMPLETE STEAM GENERATING UNITS

AND FUEL BURNING EQUIPMENT FOR PUBLIC UTILITIES, INDUSTRIAL POWER AND HEATING PLANTS

For more data circle 527 on Post Card

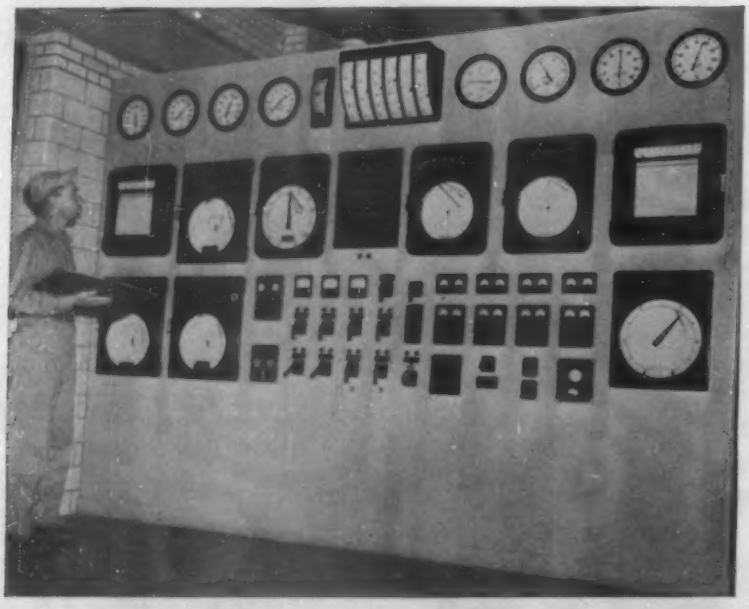
AT NEW LONE STAR STATION

REPUBLIC Automatic Combustion Control

Handles Rapid Load Changes and Selective Firing of Fuels

Lone Star Station, Lone Star, Texas
Southwestern Gas and Electric Company
Sargent and Lundy, Engineers

The speed and versatility of modern electronics are bringing fast control response, easy operation and flexibility in fuel firing to Southwestern Gas and Electric's new central station near Lone Star, Texas. Placed on the line this spring, the 54,000 KW plant incorporates many of the latest ideas in power plant design, including a Republic Automatic Combustion Control System with Telemaster Electronic master control.



Electronic master controls at this panel provide for either steam pressure or steam pressure–load control, manual setting of fuel-air ratio, fuel valves, draft fans, and selection of one of four firing methods.

The plant is arranged to fire both natural and coke oven gas. Automatic fuel selector controls provide for four firing combinations:

- **#1 Automatic preferential control of coke oven gas in accordance with its availability, with sequential make-up of natural gas.**
- **#2 Manual control of the coke oven gas proportion, with sequential make-up of natural gas.**
- **#3 Block or adjusted constant flow of natural gas with coke oven gas make-up.**
- **#4 Block, or adjusted constant flow of coke oven gas, with natural gas make-up.**

Extremely fast load changes are common at the Lone Star plant. Immediate control response is possible, however, because the system uses a new type load control to get the earliest indication of a load change and provide the initial impulse for controlling fuel and air to the boiler. Electronic impulses to positioners and regulators eliminate transmission lags—enable control equipment to make immediate compensations for changing loads. Steam pressure control is also possible if desired.

According to Mr. John Turk, Chief Engineer, the electronic control system is extremely simple to operate. Operators regularly run the plant on automatic between maximum capability and a minimum load of 15,000 KW, although wide range automatic operation was not planned when the control system was designed. The three-element Republic feedwater control in the plant is left on automatic to essentially zero load.

For more complete details about Republic Combustion Controls, write for Data Book.

REPUBLIC FLOW METERS CO.
2240 Diversey Parkway, Chicago 47, Illinois

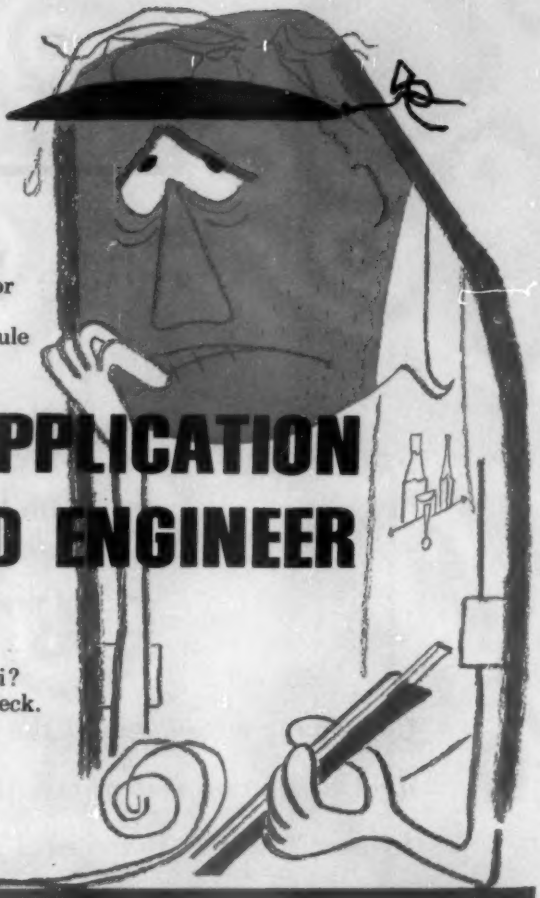
For more data circle 528 on Post Card

S/K apades in industry

Take pity on Herman
(an overworked engineer).

With time at a premium, busy, busy Herman had to suggest an economical method for reducing the temperature of superheated steam to the lower temperatures required for operating auxiliary equipment and for use in process operations.

Herman decided a jet was ideal for the job. Herman was right!
He took pencil, paper, and slide rule in hand and settled down to



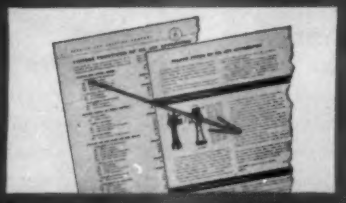
THE CASE OF THE JET APPLICATION AND THE OVERWORKED ENGINEER

work out the problem . . .

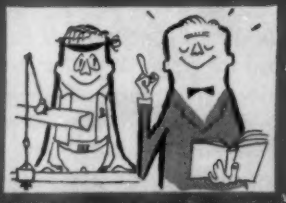
Syphon? Eductor? Exhauster, compressor, jet vacuum pump? psi? gpm? Derivation, computation, check.

Herman was wrong! And, he knew it—knew there had to be an easier and better way.
So this is what he did . . .

Wrote to Schutte and Koerting Company for a copy of new Bulletin J-1 on "Jet Apparatus and Its Industrial Applications." Found out what he needed to know about the characteristics, varieties, and ranges of Jet Apparatus.

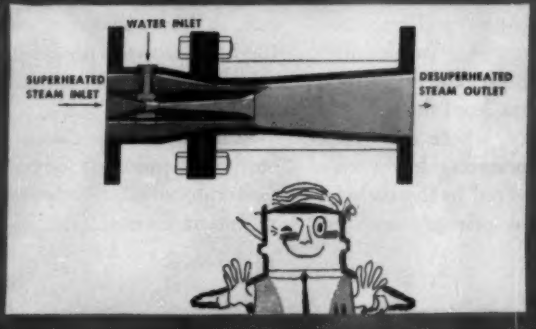


Learned the amount required and the types of jets suitable for such a function. Identified the type most suitable for his particular requirements.



Called in a specialist—his closest SK Sales Engineer—who gave him a specific recommendation.

SOLVED THE PROBLEM EASILY! The SK Fig. 894 Venturi Type Desuperheater shown has been installed in the superheated steam line. Temperature reduction is accomplished by bringing the superheated steam into intimate contact with water, cooling the steam by evaporating the water. The unit is normally arranged to provide automatic control of the temperature.



Moral! Request a copy of Bulletin J-1 for your files. Make use of a qualified specialist, your nearest SK Sales Engineer.

Schutte and Koerting
COMPANY
MANUFACTURING ENGINEERS

2221 STATE ROAD, CORNWELLS HEIGHTS, BUCKS COUNTY, PA.

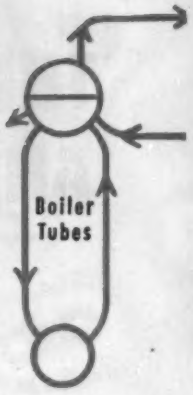
Jet Apparatus • Heat Transfer Equipment
Strainers • Condensers and Vacuum Pumps
Oil Burning Equipment • Rotameters
Flow Indicators • Radiafin Tubes • Valves
Spray Nozzles and Atomizers • Gear Pumps
Desuperheaters

For more data circle 529 on Post Card

dual circulation

provide high-purity steam

- with high feedwater makeup
- with high silica content feedwater
- at pressures above 600 psi



Cost-saving advantages of the exclusive FW dual circulation system now thoroughly proved by over 6 years of successful operation

THE DUAL CIRCULATION STEAM GENERATOR was developed by Foster Wheeler to provide a practical means of reducing carryover of silica and dissolved solids from 100% makeup feedwater. At pressures over 600 psi, this carryover often causes costly turbine outages. With today's trend to higher pressures and temperatures, and larger sized units, carryover problems are sharply accentuated and the dual circulation principle offers still greater advantages.

As shown in the diagram above, the Dual Circulation Steam Generator utilizes two separate heat-absorbing sections, each with its own independent natural circulating system. The primary section, comprising principally the furnace walls, is blown down at a high rate, providing the feed to the secondary section. Steam from the secondary system is returned to the primary, where it is condensed in whole or in part by the incoming feedwater. Hence, virtually all of the steam delivered to the turbine is generated in the low-concentration primary section, thus sharply reducing silica carryover and total dissolved solids.

Predicted data on the first FW Dual Circulation Steam Generators have been fully confirmed by more than six years of operation with five 300,000 lb/hr, 1350 psi units having 100% makeup. Average silica carryover is only .004 ppm, compared to .08 ppm expected for a boiler of conventional circulation. Carryover of total dissolved solids is .007 ppm, compared to .56 ppm expected for a conventional unit.

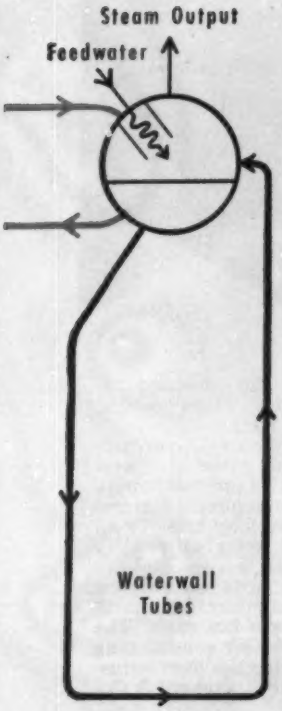
Additional benefits include reduction of tube damage due to low concentration in primary section; reduced final blowdown with substantial saving in blowdown heat recovery equipment; and reduced cost of the makeup treating plant.

Wherever *high purity steam* is required, in central station or industrial service, FW Dual Circulation Steam Generators offer important savings in operating and maintenance cost.

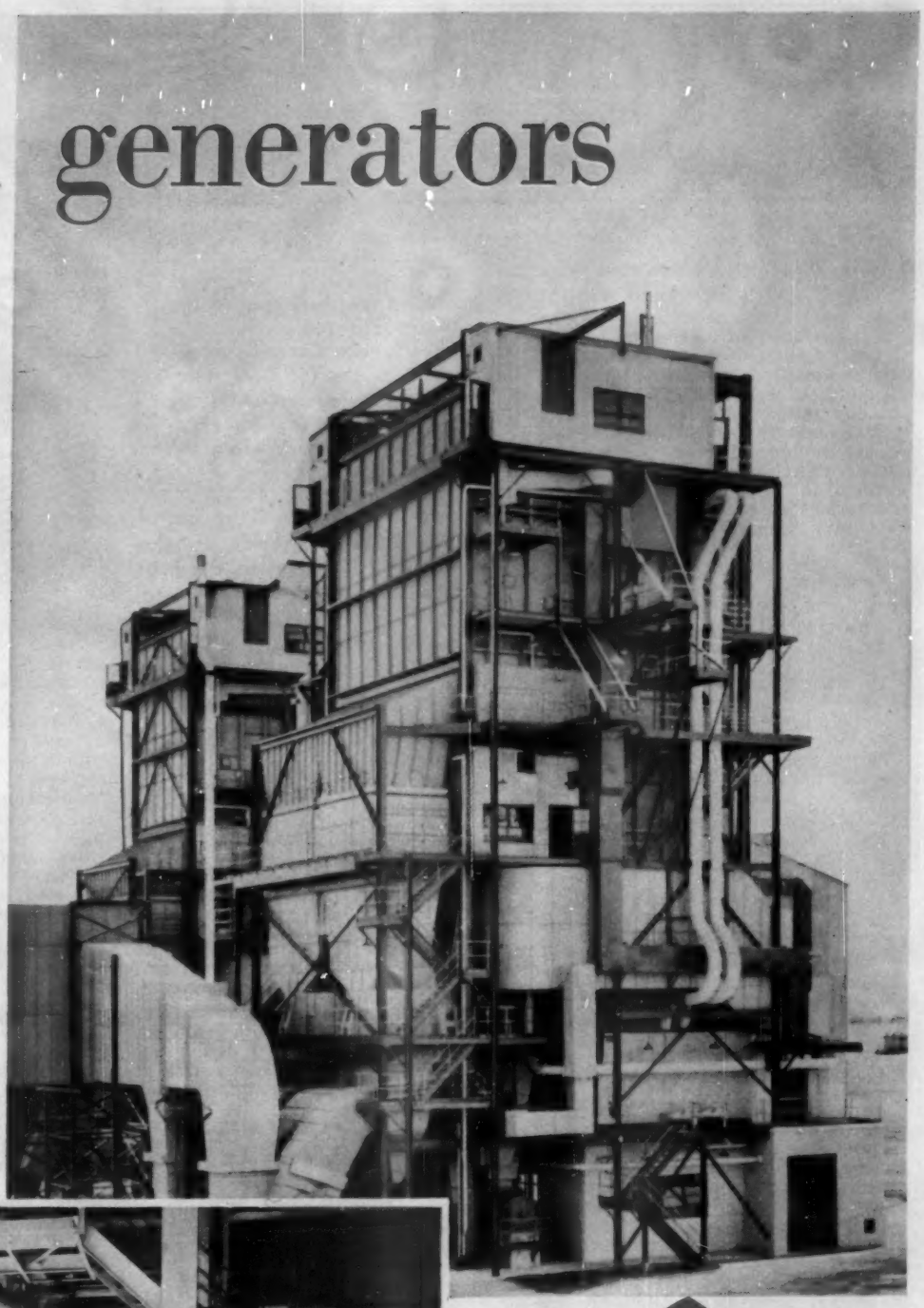
FOR COMPLETE INFORMATION on FW Dual Circulation Steam Generators, send for your free copy of 16-page Bulletin B-50-11. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

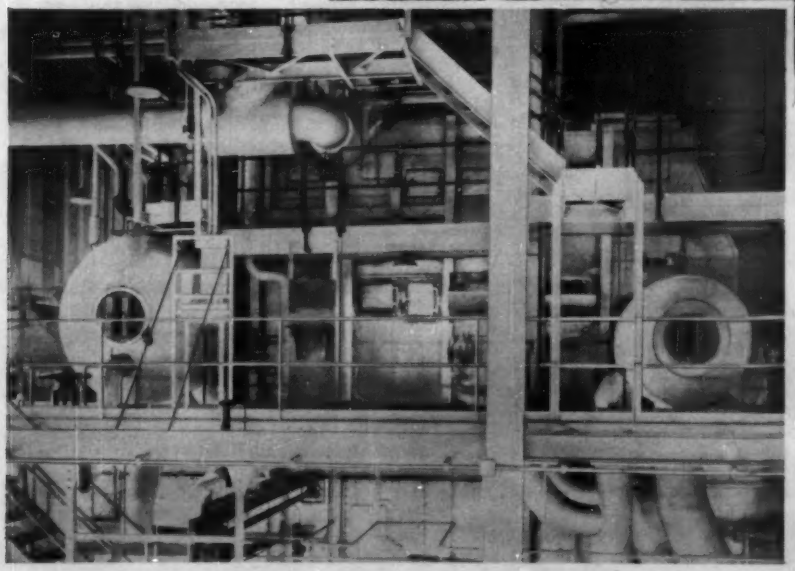
steam generators



Simplified flow diagram of typical 3-drum Dual Circulation unit. Blowdown from primary feeds continuously into secondary section. Final blowdown is from secondary drum.



KANSAS GAS AND ELECTRIC CO. recently installed these two FW Dual Circulation units at the Murray Gill Steam Electric Station. One has a capacity of 425,000 lb/hr and the other, 625,000 lb/hr —both operating at 1350 psi, 955F. Consulting Engineers were Ebasco Services, Inc.



A LARGE MID-WESTERN REFINER has installed five FW Dual Circulation Steam Generators, each unit designed for 300,000 lb/hr at 1350 psi, 900F, with 100% feedwater makeup. Photo shows upper drums of one of the five 3-drum units. Consulting Engineers were Stone and Webster Engineering Corp.

For more data circle 530 on Post Card

EQUIPMENT NEWS

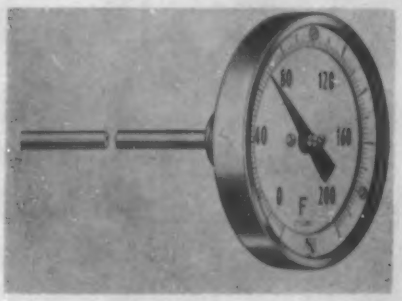
Described on these pages are new and improved products. Use Reader Service Cards on pages 99–100 to ask for more information on them. Just circle the item numbers of all the products in which you are interested.

1—BUS DUCT with aluminum bars is lighter in weight

This bus duct, announced as 35 per cent lighter overall than its copper counterpart, has double silver-coated aluminum bars to provide low resistance contacts as joints. It is available in ratings of 225-amp through 4000-amp. Manufacturer reports that the aluminum bars are put through a 12-step process which includes an acid dip and a zincate dip in addition to the strike, electroplating, and various cleaning and rinsing steps. This plating process is designed to eliminate all possibility of electrolytic action. Westinghouse Electric Corp.

2—THERMOMETER affords easy reading at process source

Accurate readings of process changes can be obtained in the field with the same ease and economy as pressure readings, with the stainless steel Bi-Metal Dial Thermometer, says manufacturer. For accuracy in reading, these thermometers



have a new anti-parallax Maxivision dial. Graduations are carried on a raised ring, set close to the cover glass, with the index-type hand at the same level to overcome perspective effect of pointer above dial and minimize chance of error.

Only 3-in. in diameter, the new thermometer has bi-metal coils welded to the stem plug and is centered in the stem to eliminate possibility of retard effect or inaccuracy caused by coil rubbing on side wall. Ranges are available from −80 to 1000 F, with Fahrenheit or Centigrade dials. Manning, Maxwell & Moore, Inc.

3—FLOW METER for water and sewage applications

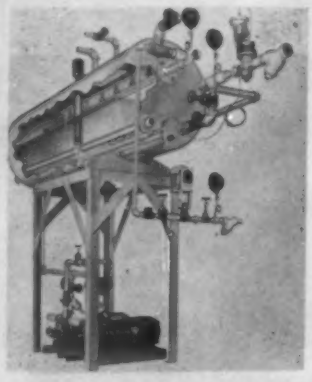
This float-actuated flow meter can be used to measure flow rates through weirs, Parshall flumes and other open channels. It combines recording, indicating, and totalizing functions in one instrument, and is capable of holding its calibration indefinitely, manufacturer says. It may include pneumatic control and transmission. Applications include flow measurement in sewage and water, measurement of sand expansion during backwashing in water filtration, flow measurement in waste treatment. Minneapolis-Honeywell Regulator Co.

4—NAIL DRIVER speeds up the masonry nailing jobs

The Safe-T-Matic Nail Driver is announced for driving nails into concrete, cinder blocks, light and medium gage metals quickly and safely. It has a built-in permanent magnet which holds the nail in position and a sliding safety shield reported to cut working time 80 per cent and eliminate flying nails. Nails driven with the Safe-T-Matic are claimed to have strong holding power and do not require use of star drills, plugs and screws. The tool takes masonry nails of ½ to 1⅛ in. long. It can be used for fastening clamps to cement or cinder block walls or cables, conduits, tubing, brackets. Safety Nail Driver Corp.

5—DEAERATING HEATER reduces oxygen content

The "03" is capable of reducing oxygen content in boiler feedwater down to 0.03 cc per liter, says manufacturer of this new deaerating heater. Its design features "floating" temperature control at 211 F through one or more internal non-

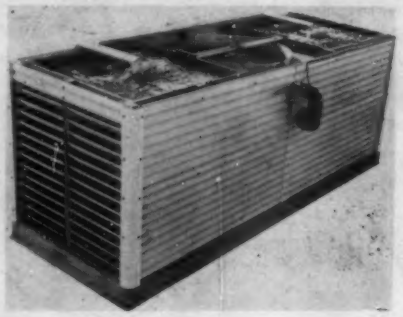


ferrous steam distributing tubes, with control by means of a combination temperature and pressure regulator responsive to a ¼ deg temperature change at the bulb. It operates with an unrestricted vent for free release of non-condensible gases. The vent condenser is of the direct spray contact type.

The interior of the heater is Chromasoid lined, and a magnesium electrolytic corrosion inhibitor is also standardly employed to offer protection against galvanic corrosion in interconnecting pipe lines. The "03" is available in sizes to handle loads to 1000 hp or 30,000 lb per hour. Bulletin 1300 provides details. Fred H. Schaub Engineering Co.

6—COOLING TOWER for air conditioning, other uses

The Lo-Line is an induced draft cooling tower designed to solve two problems. Its low overall height and attractive exterior casing of corrugated cement asbestos board meet the trend toward suburban building of lower-lined structures. Also, its easily-concealed low



silhouette answers the demand of metropolitan buildings where cooling towers must be roof mounted.

While the tower is designed to accommodate conventional external water supply piping, concealed internal supply piping is available as an optional feature. Lubrication is facilitated by bringing all fittings to outside of tower where they may be reached without ladders. Hot-dip galvanizing of steel parts assures low maintenance, says manufacturer. Stainless steel is used in the fan shaft. The tower comes in sizes for air conditioning loads of 75 tons and up, also light industrial cooling jobs. J. F. Pritchard & Co.

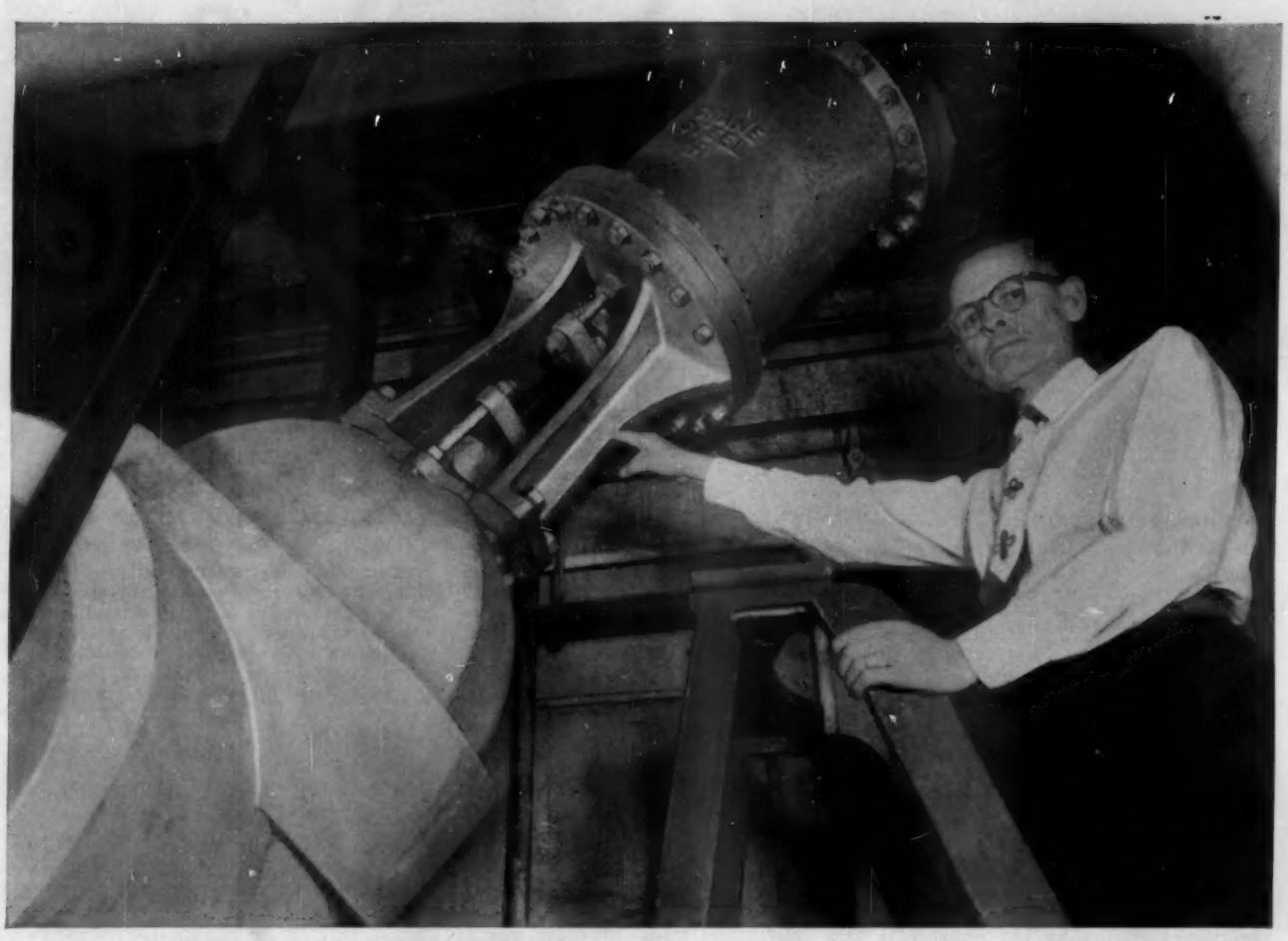
7—PNEUMATIC RELAYS control air volume, pressure

Representative functions performed by this line of air relays include air volume amplifying; pressure reversing, retarding, advancing and averaging; differential controlling, and minimum pressure controlling. One interesting device allows the highest of two varying air supply pressures to determine the control pressure. Another acts as a check valve, permitting air flow in one direction only. An electro pneumatic valve allows air passage only when the solenoid is energized.

Control in most cases is gradual although snap action is available in some devices. Direct or reverse action are standard options on many relays. The general design of the relays is described as compact, simple and rugged. A feature common to most is ⅛-in. NPT connections for air pressures to about 25 psi. Detailed information is in Bulletin 359. The Powers Regulator Co.

8—SUPERVISORY SYSTEM offers increased operating range

This 24-point supervisory system is announced as having double the operating range of manufacturer's previous design and a simplified adjustment of coding relay timing. Company engineers expect this new system to fulfill more than half of all user requirements for the remote



This CRANE VALVE begins new life after 37 years' service!

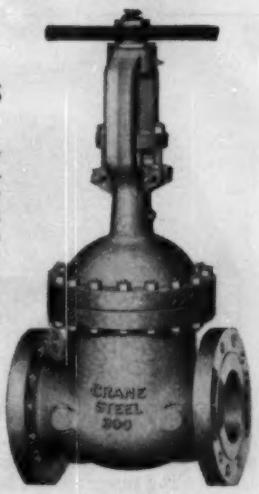
THE CASE HISTORY—World War One still raged when Cincinnati Gas & Electric Co. installed this Crane steel gate valve in 1917 at its Front & Rose Street Station. Ever since, it has safely controlled the main steam lead to No. 1 turbine—always making tight closure when needed—always responding smoothly to its hydraulic operator. For 37 years it has given such service with no more than routine maintenance—under operating pressure of 250 psi at 600 deg. F.

In 1954, the No. 1 turbine was renewed. The Crane steel valve —with complete confidence in Crane durable quality as demonstrated—was given limited preventive maintenance while down, and reinstalled in its original location.

Long life with minimum maintenance is a deeply rooted characteristic of Crane valves. That's what makes them industry's first choice today for low ultimate cost.

CRANE STEEL GATE VALVES
...a complete line

Here is steel casting at its best, by the pioneer in steel valve development. Here is value in durability . . . dependable operation . . . and in low-cost maintenance that sets Crane steel valves apart from the ordinary. They're made for every service—in all pressure classes and sizes. Consult your Crane Catalog or Crane Representative.



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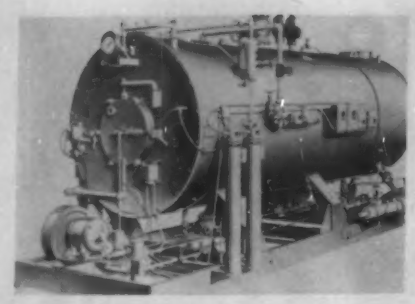
control and indication for substations and small generating stations. All devices in both master and remote stations are mounted on the front panels. Adjustment of coding relay timing can be made by turning a rheostat knob.

It is explained that because of a greater permissible tolerance to impulse or code distortion by the channel, the system permits an increase of more than twice the previously permissible direct wire channel length. In addition, the systems can be used over electronic channels of slower response type than previously possible, it is noted. The system can also be used with frequency type telemetering over channels with the required characteristics suitable for the individual operation of the supervisory and telemetering systems. Each station is 26 in. wide, 15½ in. deep and 90 in. high. General Electric Co.

9—SHOCK ABSORBER to prevent water hammer in pipes

Manufacturer of this shock absorber points out that while many relief devices can be used to keep water hammer within bounds, the action and counteraction in these units weaken the device with each flex of pressure, thrust or impact due to the molecular structure of these relief devices. This newly announced shock absorber is claimed to be so designed that it will permit molecular displacement and return to its original form immediately after the force used to distort it is removed.

Due to a specially milled Absorbo insert and compression molded tube in the steel shell of this shock absorber, the thrust and impact of water entering the tube expands it against the insert until the energy caused by the pressure is dissipated, it is explained. As the shock recedes, the tube and insert regain their original form, ready to receive the next shock impulse. Company says the device is leak-proof. It comes in sizes from ½ to 2 in. Josam Mfg Co.

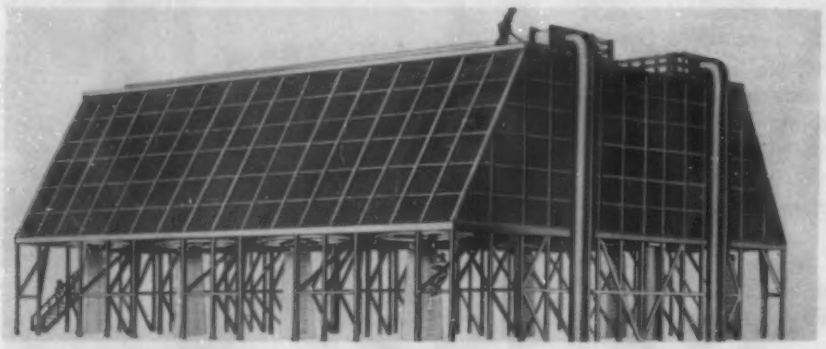


11—PACKAGE BOILERS are compact efficient units

Model X Packaged Steam Generators built to the same specifications as company's Model A line, are designed to deliver equivalent horsepower in smaller physical space. Of three-pass design, the new model has a minimum of 4 sq ft of heating surface per boiler horsepower and is priced lower than the other model. It is shipped as a ready-to-fire unit, complete with burner, controls, insulation and jacket. Model X is available in 19 sizes, 15 through 600 hp, for pressures from 15 to 200 psi. Ames Iron Works, Inc.

12—VACUUM TUBE VOLTMETER is battery operated

Model 982 Vacuum Tube Voltmeter is described as adaptable where requirements of peak to peak measurements exclude the use of conventional meters. Battery operated, it is isolated from spurious response due to stray a-c fields and circulating ground currents. Peak to peak measurements with an input impedance of 10 megohms shunted by 15 micromicrofarads prevents circuit loading it is noted. One shielded lead is used for all measurements, and a range function switch makes negative and positive d-c potentials measurable directly. A circular lists prices, ranges. Weston Electrical Instrument Corp.



10—COOLING TOWER is designed to control recirculation, wind

Wind doesn't hamper the performance of the Wind-trol, says manufacturer of this cooling tower; it can be located without respect to wind direction. It is designed to nullify the effect of recirculation caused by the tower structure upon itself. Uncontaminated air passes beneath the structure and supplies fans on both sides of the tower with an excess of air discharging from the tower's leeward side. Recirculation is prevented, it is explained, because the exhaust vapors must move against this discharging wind stream. According to company, the control of recirculation makes this forced draft tower practical and economical.

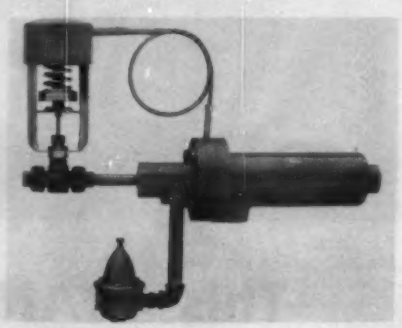
Mounted on an open substructure, the tower and its redwood basin are supported by "cast-in-place" concrete piles — for which the holes are driven by a mechanical auger and without using forms. The design is also said to afford protection from vibration damage. Forced draft fans, mounted on the ground on steel pipe columns or small concrete structures, are not connected to the Wind-trol structure — they're outside of the packing area, discharging vertically, in the external plenum area, and so placed that sunlight, rain, or hot vapors don't come in contact with blades. Santa Fe Tank and Tower Co.

13—SAFETY SWITCH, dust resisting, for heavy-duty use

For heavy-duty industrial use, this Type H safety switch has a dust-resisting enclosure and, for safety during maintenance, Micarta laminated shields over the line terminals. Designed to exceed NEMA and government specifications for Type A switches, it is offered in ratings from 30 to 1200 amp, 600 v and below. Incorporation of the operating mechanism within the operating handle leaves the side gutters free from wiring. Copper parts are tinplated to prevent corrosion and oxidation and switch bases are coated with iron oxide to increase moisture resistance and dielectric strength. A Neoprene gasket, compressed by truck-type cover latches, provides an effective cover seal. Westinghouse Electric Corp.

14—STEAM-WATER MIXER supplies hot water

Utilizing full heat energy by injecting steam directly into the water, this steam-water mixer (1360 series) is announced for use wherever hot water is required, and steam and water are available. It has a wide range of adaptability, including wash wheels in laundries and tanner-



ies; wash water in textile mills, sugar mills, chemical plants, and in supplying hot or warm water to wash stands and gang showers. A safety feature is incorporated to shut down mixer in event of failure of water supply, and automatically resume operation when condition is corrected.

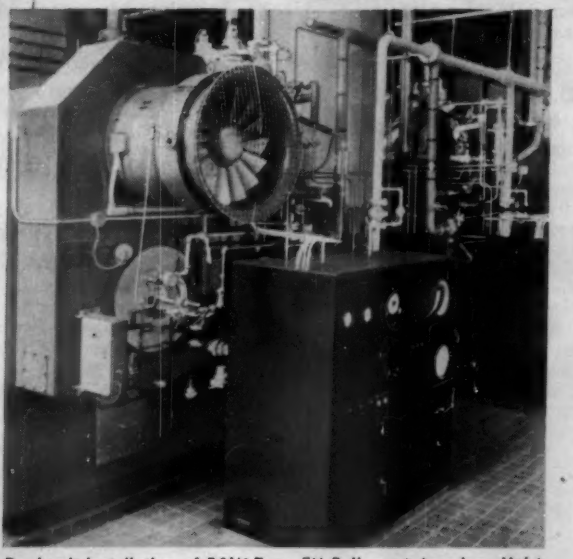
The sensing bulb design has more surface area than usual, company says, and the turbulent blending action on interior produces instantaneous response of thermostatic assembly and assures accurate control of water temperature at desired point. The mixing chamber is designed to prevent stratification and false temperature indications. It is also claimed that inherent noise accompanying injection of live steam into water is held to acceptable level by a variable orifice feature of the steam injection nozzle. Available in five temperature ranges, the control costs about 15 per cent less than company's previous models. Fulton Sylphon Div., Robertshaw-Fulton Controls Co.

15—BLEEDER VALVE is low in cost, has many uses

Designed for 20,000 psi safe working pressure or temperatures to 1200 F, the new stainless steel Graloc Vent-Drain-Bleeder Valve sells for around $3.00 and $3.50 in ½- and ¾-in. sizes. A pressure-aided seat is incorporated to make it leakproof for oil, water, gas or steam service. It is fabricated from a combina-

keeping steam cheap . . .

Low Cost Steam
produced here



Dual-unit installation of B&W Type FM Boilers at American Hoist and Derrick Company plant, supplying steam for processing and heating.

Helps American Hoist
cut costs here

Aerial view of large plant and facilities of American Hoist at St. Paul, Minnesota.

To reduce substantially its overall steam generation costs and overcome the problem of meeting wide and erratic load swings due to the use of steam hammers in the forge shop, American Hoist and Derrick Company of St. Paul, Minnesota replaced two old boilers with two B&W Type FM Boilers.

Now in service for over a year, the compact FM Boilers are providing steam for both processing and heating . . . are readily meeting all the service conditions under the direction of their automatic controls. Each unit has a steam capacity of 25,000 lb per hr at 200 psi, is equipped with a superheater to provide steam at proper temperature for various plant operations, and is designed to burn either gas or oil.

The FM Boiler is ideal for small to medium-sized operations, and has been widely applied to many larger installations as well, where multiple FM units have been found to be practical and more economical than one or more larger boilers requiring complete field erection and close operating supervision. The FM is self-contained and easy to install. For example, many have been set in place with equipment similar to that made by American Hoist. It is delivered complete with firing equipment and controls. This versatile steam generator is enjoying wide popularity with users in a large variety of industrial, commercial, institutional, and other classifications. The number of units now in service or on order have a total steam capacity of more than 9,000,000 lb per hr. It is available in standard sizes for loads ranging between 2900 and 36,000 lb of steam per hr at pressures to 235 psi. Special units for higher pressures are also obtainable.

The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

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tion of Types 410 and 416 stainless steel and declared suitable for essentially any fluid or atmosphere and as providing maximum resistance to galling. It may be used for vents and drains at the high and low points of piping, equipment and instruments, to bleed at double block valves, as freeze drains. Gray Tool Co.

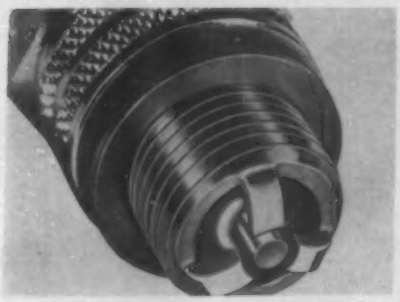
16—ADJUSTABLE SPEED DRIVE has operating advantages

The Dynaspede Coupling is a stationary field, liquid cooled, eddy-current adjustable speed power transmission device. Driven by a constant or variable speed power source, the Dynaspede Coupling is designed to deliver torque or speed to suit specific processing requirements. The absence of rotating electrical components is claimed to result in reduced maintenance and in adaptability to hazardous, moist, dirty and other adverse locations. Also, the liquid cooling utilized is said to provide an effective heat transfer medium, permitting wide speed ranges at constant or reduced torque and, under certain conditions, constant horsepower. Bulletin SF-1 furnishes more details. Dynamatic Div., Eaton Mfg. Co.

17—SPARK PLUG designed to boost engine power

The TC-3 is announced as a triple electrode spark plug with concave ground electrodes that "brings the aviation spark plug down to earth" for use in gasoline-powered equipment. It can be used in automotive engines to gain four advantages: lower fuel consumption, more power and less plug fouling.

In addition to triple electrodes, the TC-3 also adapts a solid copper gasket to



position the spark in the combustion chamber, and a 95 per cent aluminum oxide insulator used in jet plugs. With three electrodes, the TC-3 is said to carry its own insurance. The three gaps are factory set. If one electrode burns or erodes away beyond the most efficient gap setting, two others remain properly set to make sure of complete combustion, manufacturer points out, and plug life is doubled. Turbulence of the fuel mixture around the three electrodes and through open gaps minimizes lead fouling and cools plug nose. Fired at a higher temperature than many spark plug insulators, the TC-3 insulator, according to manufacturer, has an extremely high density capacity, which helps to resist fouling. Auburn Spark Plug Co.

18—WALL RADIATION comes in one-to-three tier assemblies

Thermo Vector comes in one, two, or three tier assemblies, and may be flush mounted anywhere along a wall at a minimum of 4 in. above the floor. It may be used with steam or with hot water. Made of heavy furniture steel, the Thermo Vector enclosure has front outlet grille which directs warmed air from walls to prevent smudging. It can be painted to match any room interior, has a lever damper, and accessories are available to conceal piping and connections. Steel and non-ferrous elements come with either 3¼ or 4¼ in. fins. The unit is claimed easy to install, with element supports that attach to front retaining clip, or if desired, optional full back. C. A. Dunham Co.

19—STEAM SEPARATOR for handling boiler blowdown

This non-pressure type all-steel welded vessel with dished ends and taper design is announced as offering low cost, positive acting and quiet separation of flash

from water and sludge. Blowdown enters tangentially at the top periphery of the vessel. An external spiral baffle, extending into drain, assists the swirling action — solids fly outward and down — only clean flash is vented to steam line. It is explained that the taper design assists separation while keeping water-sludge "momentum pressure" on drain. The separator serves one or more boilers. Company states that it has large outlet openings which classify it as a non-pressure vessel. Pennsylvania Separator Co.

20—RELAYS, CONTACTORS are mechanically-latched

Designed for maintaining continuity of sequencing in the event of power interruptions, these mechanically-held contactors and relays are also suggested for use where quiet operation is required. They eliminate continued energization of the coil, thus eliminating coil hum, according to company engineers. After the main device coil is momentarily energized to seal the contacts, the mechanical latch locks contacts in position until latch coil is energized. For this reason, when power is restored after a failure, sequenced operations will resume at the exact point in cycling where they were cut off, it is pointed out.

With contacts interchangeable from normally open to normally closed position without additional parts, the mechanically-held devices are front-connected for convenient wiring. Contact springs are permanently attached to movable contacts to facilitate removal and installation. Contactors are available in NEMA sizes 00, 0, 1, open and enclosed, and in 1, 2, 3, and 4 poles. Multipole relays are available in 10-amp, 600-v max ratings, open and enclosed, and with 2, 3, 4, 6, and 8 poles, in any combination of normally open and/or closed positions. General Electric Co.

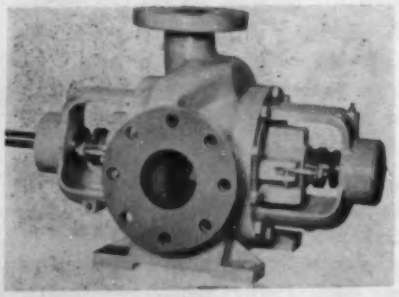
21—BRUSH TOP CANS are easy to use, and prevent waste

Made in quart, pint, half-pint and 3/16-pt capacities, these brush top cans are used as a convenient means for applying pipe sealing dope when making

connections; soap suds and similar solutions when checking for leaks; touch up painting jobs; using cements, and fluxes; spot application of lubricants; "Prussian blue" testing. The cans have either a ring handle or a detachable wood handle, both of which permit easy carrying or storing in tool kits. Lugs soldered on opposite sides of the screw cap facilitate opening, even with greasy hands. The brushes are 1- or ½-in. wide flat brushes vulcanized in rubber and soldered to screw caps. Or the same cans can be furnished with daubers, if preferred. George D. Ellis & Sons, Inc.

22—TURBINE PUMPS are two-stage regenerative type

These two-stage turbine-type pumps are designed for boiler feed service with boilers up to 1000 hp operating at pressures to 300 psi. They are equipped



with low pressure stuffing boxes which are obtained by use of a throttle bushing under stuffing box and a bleed-off arrangement back to the low pressure area in pump. According to manufacturer, this arrangement enables operator to pack for low pressures while pump is operating against highest obtainable differential heads. Balanced shaft loading is also provided by opposing discharge of first stage to the discharge of second stage. Ten models in the 2000 series and nine models in the 3000 series are available in standard fitted, bronze fitted, all iron, and all bronze construction. All models have stainless steel shafts. Bulletin 107 gives more information on the pumps. Roy E. Roth Co.

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POWER PIPING
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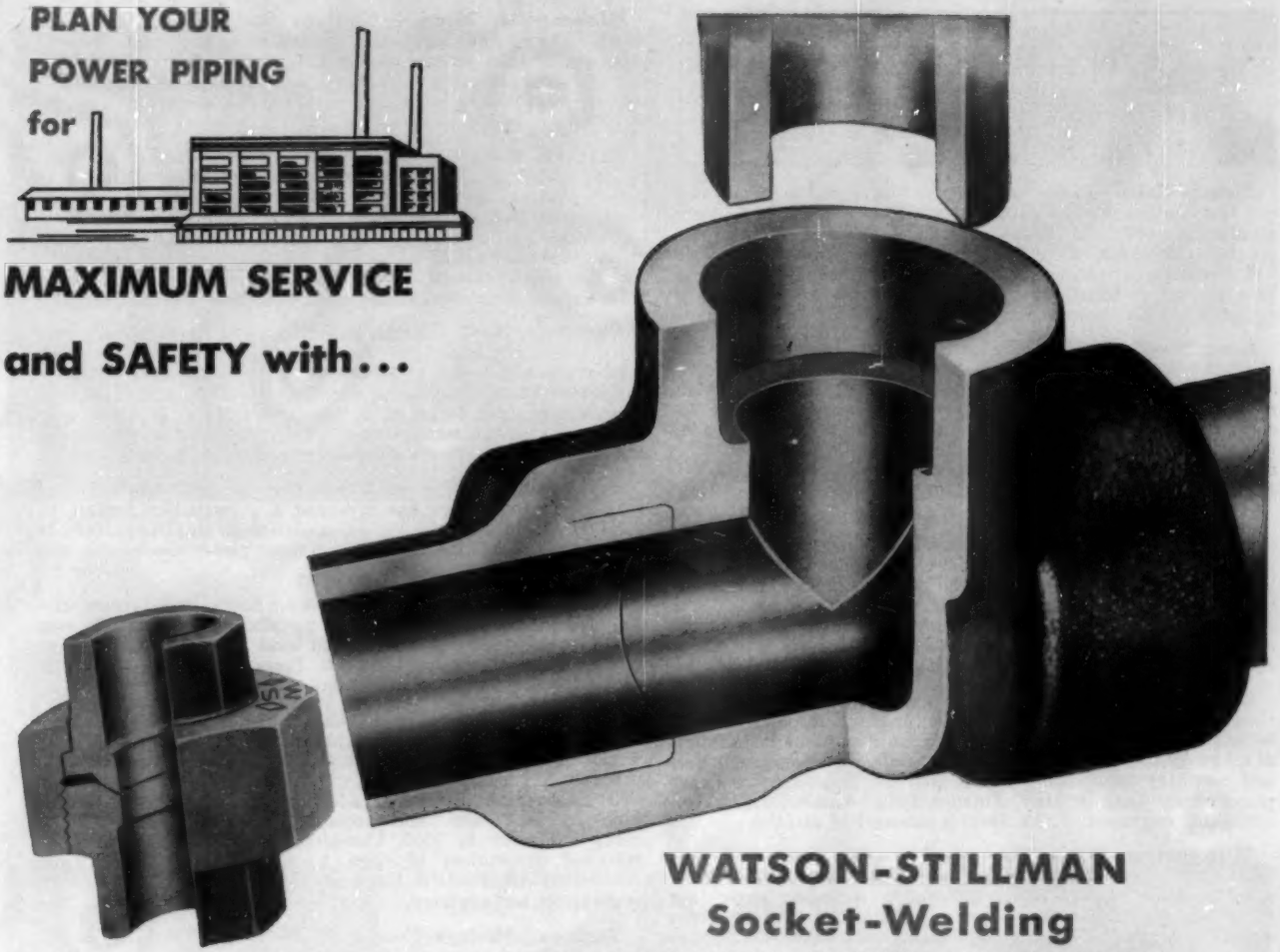
MAXIMUM SERVICE
and SAFETY with...



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Socket-Welding
ALLOY STEEL FITTINGS

1¼% Cr—½% Moly **2¼% Cr—1% Moly**

Watson-Stillman Socket-Welding Pipe Fittings provide strong, tough trouble-free joints for high pressure, high temperature steam piping. W-S high quality forged alloys are available to meet the severest conditions. They have excellent dimensional stability, good corrosion resistance and freedom from graphitization—three basic properties necessary for safe, reliable operation at high temperatures and pressures. In addition, the fibrous metallurgical structure of W-S drop-forged fittings provides extra strength and toughness to resist shock and vibration.

Watson-Stillman Socket-Welding Fittings are easy to install. Deep sockets support and align the pipe. No need for tack welding or special fixtures. Just slip the fitting over the pipe and weld.

Watson-Stillman also manufactures a complete line of Forged Screw-End Fittings in the above alloys. All W-S fittings are also available in carbon steel and in several grades of stainless steel.

Write for information today.

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

Roselle, New Jersey

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CONSTRUCTION NEWS

Bishop, Calif. — Dept. of Water & Power, 311 South Spring St., Los Angeles, Calif., plans construction of new hydroelectric generating plant near Bishop, in connection with a five-year program for expansion in power and water facilities. Project will include construction of power dam in Pleasant Valley, near Bishop, and installation of hydraulic turbines and auxiliary equipment. Cost estimated about $2,300,000.

Long Beach, Calif. — Southern California Edison Co., 601 Fifth St., Los Angeles, Calif., has engaged Bechtel Corp., 4620 Seville Ave., Vernon, Calif., consulting engineer, to design and supervise construction of proposed new Alamitos steam-electric generating plant on San Gabriel River, near Long Beach, previously noted in these columns. It will be equipped for a capacity of 156,000-kw., with total cost reported at $24,000,000. First unit is scheduled for completion in 1956.

Los Angeles, Calif. — Dept. of Water & Power, 311 South Spring St., has plans maturing and will take bids soon for construction of proposed Scattergood steam-electric generating plant, to be located on boundry of Los Angeles-El Segundo, near International Airport. Installation will include two 156,000-kw. turbine generator units, with high-pressure boilers and auxiliary equipment, the first unit being scheduled for completion in 1957. Entire project is estimated to cost close to $50,000,000.

Colorado Springs, Colo. — In connection with expansion in George Birdsall municipal electric power plant, recently referred to in these columns, Dept. of Public Utilities plans installation of a new 22,000-kw. turbine generator unit, high-pressure boiler, and auxiliary equipment. Plans and specifications are being prepared by Lutz & May, Finance Bldg., Kansas City, Mo., consulting engineers. T. M. Hohl is manager of utilities.

Wilmington, Del. — Delaware Power & Light Co., 600 Market St., has arranged an expansion and improvement program in 1955 to cost about $9,500,000, including generating facilities, transmission lines, power substations, etc. Program includes installation of a third generating unit, 78,000-kw. capacity, at Edge Moor power plant, in course of construction for a number of months past, and scheduled for completion this year.

Idaho — Jefferson Lake Sulphur Co., Whitney Bldg., New Orleans, La., sulfur, superphosphates, etc., is reported planning steam power plant in conjunction with proposed new plant in southeastern part of Idaho, where site is being selected. It will be used for production of sulfuric acid and other chemical products. Entire project reported to cost over $3,000,000. George F. Wilkens is vice-president, in charge of western operations.

Peoria, Ill. — Central Illinois Light Co. has plans maturing for expansion in local generating station, including installation of a new 100,000-kw. turbine generator unit, high-pressure boiler and auxiliary equipment, designed to advance plant capacity by close to 50 per cent. New unit is scheduled for completion in 1957, and is included in company construction program for 1955–57, for which an appropriation of about $20,000,000 is being arranged.

Cedar Rapids, Iowa — Iowa Electric Light & Power Co. has disposed of a bond issue, totaling about $9,000,000, proceeds to be used primarily for 1955 expansion and improvement program, including generating facilities, power substations, transmission lines and miscellaneous work.

Ford, Ky. — Eastern Kentucky Rural Electric Cooperative Corp., Winchester, Ky., expects to begin work in March on proposed addition to William C. Dale power plant, near Ford, previously noted in these columns, with work to be completed during summer of 1956. Project will include installation of new 6000-kw. generating unit, high-pressure boiler and auxiliary equipment. Entire program reported to cost close to $6,000,000, with extensions in transmission lines, power substations and other operating facilities. Stanley Engineering Co., Hershey Bldg., Muscatine, Iowa, is engineer.

Searsport, Me. — Northern Chemical Industries, Inc., Searsport, agricultural and industrial chemicals, plans new steam-electric generating station, with capacity of about 7500-kw., in connection with new chemical works on local site for production of anhydrous ammonia and other chemicals. Entire project reported to cost about $9,000,000. Main offices are in the Totman Bldg., Baltimore, Md. James E. Totman is president.

Minneapolis, Minn. — Northern States Power Co., 15 South Fifth St., has authorized an expansion and improvement program in 1955 to cost about $51,500,000. Of this amount, new projects including power station facilities are estimated to cost $32,000,000, of which part will be carried into work in 1956.

Natchez, Miss. — Standard Ore & Alloys Corp., 120 Wall St., New York, N. Y., metal alloys, steel specialties, plans steam power plant at proposed new chemical works near Natchez, where large tract of land has been acquired. Plant will be used for production of anhydrous ammonia, acetylene and other chemical products, and will comprise a large group of buildings. Program will be carried out by Simpson Ore & Chemical Corp., a subsidiary organization, and is reported to cost over $15,000,000.

Charlotte, N. C. — Duke Power Co., 422 South Church St., has disposed of a bond issue, totaling $40,000,000, supplementing a recent sale of bonds of $8,700,000, entire proceeds to be used for construction program of company in 1955, including new steam-electric generating plant near Belmont, N. C., previously noted in these columns, other expansion in generating facilities, transmission lines, power substations and miscellaneous work.

Baltimore, Md. — Consolidated Gas, Electric Light & Power Co., Lexington Bldg., has arranged a construction budget of $35,000,000 during 1955, including expansion and improvements in generating facilities, transmission lines, power substations, and other work.

Baltimore, Md. — Sheraton Corp., Sheraton-Belvedere Hotel, Charles and Chase Sts., plans installation of central heating plant in proposed new addition to local hotel. Entire project reported to cost about $4,000,000. Perry, Shaw & Hepburn, 31 St. James Ave., Boston, Mass., are architects.

Detroit, Mich. — Chrysler Corp., 341 Massachusetts Ave., automobiles, has authorized expansion in power plant at body works on East Jefferson Ave., in conjunction with large extension program for increased manufacture. Work at generating station will include installation of additional generating equipment, high-pressure boiler, and accessory apparatus. Proposed to carry out work in 1955. Complete program will represent a reported investment of close to $20,000,000. Albert Kahn Associated Architects & Engineers, New Center Bldg., Detroit, is architect and engineer.

Jackson, Mich. — Consumers Power Co. is planning an expenditure of about $73,000,000 in 1955, including expansion and improvements in generating plants, power substations, transmission lines, and other operating facilities. Work will include extensions in steam-electric generating plant at Muskegon, Mich., previously noted in these columns.

Kalamazoo, Mich. — Kalamazoo Vegetable Parchment Co., Parchment, Kalamazoo, writing and other papers, plans expansion and improvements in power plant at mill, including installation of new 7500-kw. turbine generator, high-pressure boiler and auxiliary equipment. Cost reported about $2,000,000.

Beverly, Ohio — Ohio Power Co., 301 Cleveland Ave., S. W., Canton, Ohio, has approved plans for expansion in Muskingum River generating station, near Beverly, with installation to include a new 225,000-kw. steam-electric generating unit, high-pressure boiler, and accessory equipment. Entire program to cost about $29,000,000, including extensions in transmission lines, power substations and other operating facilities.

Toledo, Ohio — Toledo Edison Co. has disposed of a block of preferred and common stock, to total about $15,700,000, of which $10,500,000 will be used for expansion in plant and system during 1955, including increased generating facilities, transmission lines, power substations, and other work.

Pittsburgh, Pa. — Duquesne Light Co., 435 Sixth Ave., has arranged financing in amount of about $23,600,000, proceeds to be used in connection with 1955 expansion and improvement program, including power plants, power substations, transmission lines and other operating facilities.

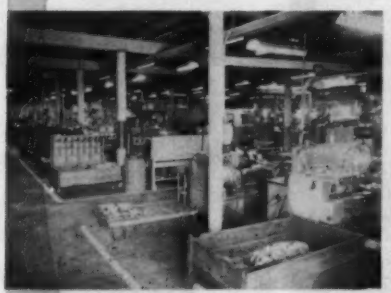
Dallas, Tex. — Dallas Power & Light Co., 1506 Commerce St., has arranged financing in amount of about $12,400,000, proceeds to be used for 1955 construction program, including extensions in power plants, transmission lines, power substations, and other operating facilities.

Alma, Wis. — Dairyland Power Corp., 123 North Fourth St., LaCrosse, Wis., has plans maturing for proposed new addition to steam-electric generating plant at Alma, previously noted in these columns, to include installation of new turbine generator, high-pressure boiler, and auxiliary equipment. Cost reported close to $8,500,000. Vern E. Alden Co., 33 North LaSalle St., Chicago, Ill., is consulting engineer.

Inner valves are machined on duplicating lathes to exacting standards. In this photo, master contour plate on lathe at (A) automatically duplicates the exact contour desired at (B) to form the inner valve.

Precision parts on BS&B Controls are manufactured to close tolerances. This lathe operator "mikes" inner valve for a final tolerance of .001". Other parts require tolerances of as little as 3/10,000"

In Automatic Controls, BS&B Means..."Trouble-Free"!



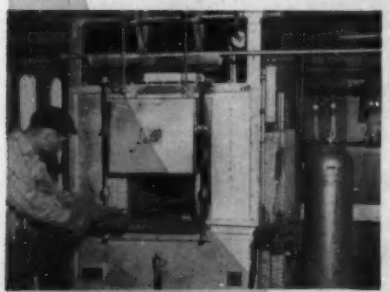
Ample production facilities and stocks of material assure prompt deliveries on all standard items in the BS&B Controls line.

Whenever you buy an automatic control, you look for the finest and most dependable one you can find for the job from the standpoint of quality, precision, long life and *"freedom from trouble."*

Freedom from trouble is especially important, because once a control is installed in the line, any "down-time" caused by its faulty operation becomes very expensive—usually many times more expensive than the entire cost of the control itself.

That's why it *always pays* to specify and buy BS&B Automatic Controls! Because of their superior quality and their long trouble-free performance, they'll *pay for themselves* in almost no time!

A Sinusoidal waveform apparatus is used to check the accuracy and performance of a BS&B Type 1440 Pressure Control Pilot.



Proper treating and hardening of certain component parts of BS&B Controls in one of these precisely controlled electric annealing furnaces is just one of the important manufacturing operations which assures their high quality and long trouble-free service.

Every BS&B Control must pass rigorous operating tests in our modern hydraulic testing and experimental laboratory. In this view, valves in the line are under test pressures from hydraulic pumps in the foreground. Operator checks readings on the control panel for valve performance.

OVER 60 YEARS
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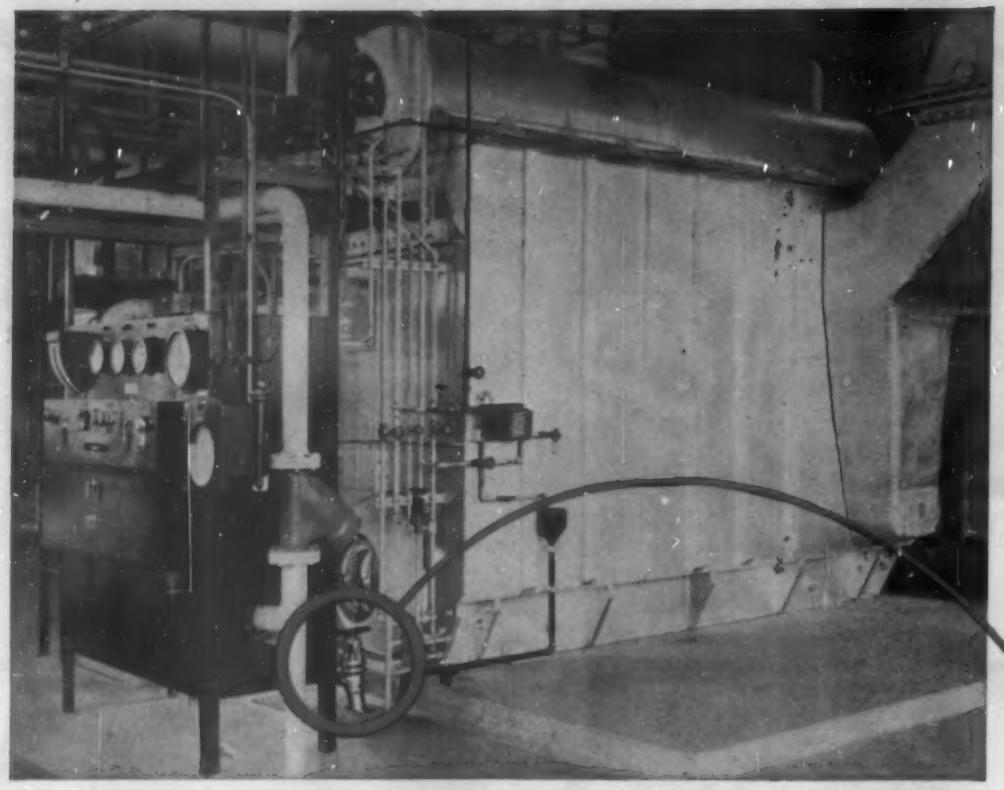


COMBUSTION ENGINEERING ADOPTS YARWAY SEATLESS BLOW-OFF VALVES FOR PACKAGE BOILERS

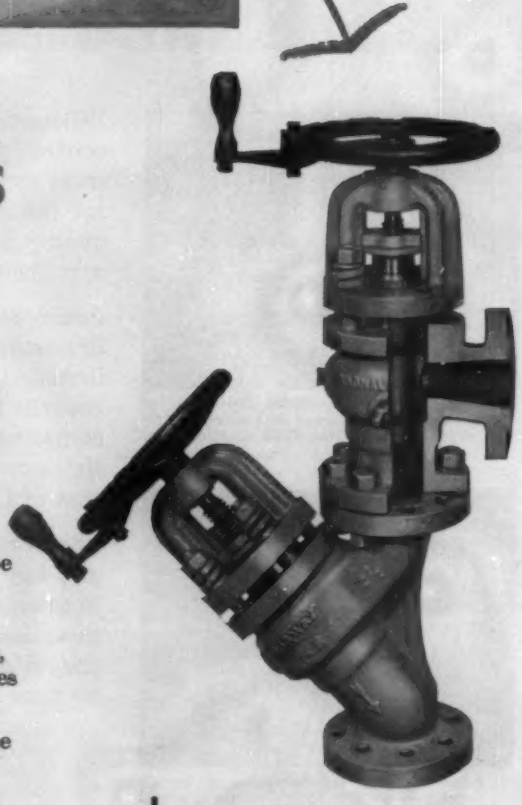
Combustion Engineering, Inc. on this package boiler installation at the Orangeburg Pipe Plant in California, again includes Yarway Seatless Blow-Off Valves as part of the "package."

It's a popular idea—and growing fast. All *good* package-type boiler installations are *better* when equipped with Yarway Seatless Blow-Off Valves.

More and more boilermakers are standardizing on Yarways, and more and more boiler users are expecting the advantages of Yarway Blow-Off Valves on their package units.

Get the full story on why more than 15,000 boiler plants use Yarway Blow-Off Valves, some for 30 to 40 years.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES



Yarway Type "B" Seatless Tandem Blow-Off Valve. Note balanced sliding plunger design with no seat to score, wear, clog or leak. Pressures to 400 psi.

YARWAY **BLOW-OFF VALVES**

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Did "Brittle Fracture" Cause Toronto Turbine Explosions?

Last April two 100,000-kw turbine generators exploded at Ontario Hydro's giant new station in Toronto. Report of the investigation, which has just been completed, will have important effects on future generator design. Here is Norman Jones' summary

IN APRIL 1954, violent explosions and fire wrecked two 100,000 kw generators at Ontario Hydro's giant Richard L. Hearn Station in Toronto. On Feb. 18, 1955, Sir Claude Gibb, Chairman and Managing Director of C. A. Parsons & Co., the manufacturers of the units, delivered a paper before the Engineering Institute of Canada, describing the investigation of these failures.

The report of the investigation so far runs into more than 200,000 words. It has been conducted by some of Britain's top metallurgists, applied mathematicians, and design engineers, and few disasters have had a more thorough and painstaking investigation.

The results of the investigation show that no single factor caused the failures, but a combination of factors, never previously experienced together, led to a stress which, repeated a sufficient number of times, brought about a failure.

C. A. Parsons & Co. are one of the largest manufacturers of turbine generators in the world, and their costly and intensive investigation has thrown light on aspects of design that should be of great value to generator designers all over the world. The full report will be published in the near future, but in the meantime here is a brief summary of the factors that contributed to the failures, and the steps that have been taken to prevent them happening again.

First — What actually happened when the generators exploded? In each case the rotor end-bell fractured. (End-bells are the steel rings shrunk over the end windings of a generator rotor to prevent the windings moving outward under the action of centrifugal force.) Broken pieces of end-bell went through the generator housing, allowing hydrogen to escape. The hydrogen ignited, and in turn ignited the lubricating oil, and so caused the fires that further damaged the machines. However, in neither case was the hydrogen a cause of the explosion.

Here are some of the factors that contributed to the cause of the end-bell fractures.

1. Non-magnetic Steel: End-bells can be made of magnetic or non-magnetic steel. Magnetic end-bells produce a flux concentration which gives increased heating, and so non-magnetic end-bells are widely used. The Toronto end-bells were non-magnetic. Composition of the steel was Ni.8%, Mn.8%, and Cr.4%. Characteristic of non-magnetic steel is that its mechanical properties can only be improved by cold working, and since it cannot be heat treated, residual stresses remain in the material.

2. Thickness: The Toronto end-bells were 58½ in. diam and approx. 3 in. thick. Tests show that thick material of this nature tends to trap more and higher residual stresses than thin sections of the same metal.

3. Cyclic Loading: Tests showed that thick sections of this metal have a low resistance to cyclic loading. The Toronto machines were subject to a particularly severe cyclic loading. One of their main functions was to absorb the peak loads on a hydro system, and so from day to day their loading fluctuated between no load and 100 mw, with the result that they were subjected to large differences of temperature. These temperature differences expanded and contracted the end-bells, causing stress fluctuations that would not have occurred on steady loading.

4. Ventilating Holes: In a generator, the coils nearer the shaft tend to run hotter than those nearer the periphery, where heat dissipation is better. Thus each coil expands and contracts a different amount, and if the temperature gradient between top and bottom coils is too great, there will be danger of coil distortion. To reduce this temperature gradient between top and bottom coils, ventilation is improved by drilling holes in the end-bells to permit cooling hydrogen to pass through. The cold-working produced by drilling gives each hole a work-hardened skin in which stresses are concentrated.

5. Location of the Holes: In both machines the end-bells that failed were at the exciter end of the machine. Now the only difference between the end-bells at the exciter end and those at the turbine end was that at the exciter end a hole was omitted close to the place where the fracture occurred. The hole was omitted because there was a coil crossover just under the point where the hole would have been drilled, and since the coil crossover would have blocked the hole and prevented its use as a ventilating hole, there was no point in drilling the hole, and so it was omitted. However, the absence of this hole increased the stress round the existing holes, and it was down a line of these holes that the fractures occurred. It seems amazing that by not drilling some holes the end-bells were made weaker, and the applied mathematicians who discovered this had difficulty in convincing people that it was true, but that's what actually happened.

All these causes together seem to add up to produce the sinister phenomenon known as "brittle fracture," about which not too much is known except that it does occur when certain materials are subject to a particular combination of factors which include residual stress, thickness, temperature, and cyclic loading.

Brittle Fracture: This has occurred in ships, gas mains, and fluid storage reservoirs — all subject to cyclic loading. The rate of propagation of the Toronto fractures was found to be about 3000 ft per sec which explains their almost explosive effect.

Though the precise causes of brittle fracture in any particular case are still indeterminate, and though the causes of the Toronto fractures are also not quite clear, the danger will be avoided in future by making end-bells of magnetic material which can be heat-treated to remove residual stresses, and by not drilling any holes in the end-bells. The new end-bells will be alloyed with Nickel, Chromium, and Molybdenum, and the disadvantages of increased heating will be avoided by improving the ventilation to reduce the temperature gradient between the top and bottom coils. This improved ventilation is obtained by providing a sub-slot beneath the usual coil slot, and hydrogen will pass along this sub-slot and up through holes in the coils to give direct conductor cooling. This gives such a great improvement in cooling that the increased heating of magnetic end-bell material will not be significant, nor will there be any need to drill ventilating holes in the end-bells!

Last April's explosions occurred within a few days of each other. The connection between the two explosions is not clear, but it is possible that the enormous shock and vibration that occurred when the first machine exploded may have been enough to affect the second machine and cause it to fail a few days later. At least, that is one theory held at present.

Fig. 1. Shows handling carriage required for oil breaker maintenance

Fig. 4. Cleaning and adjusting main contacts of typical oil circuit breaker

Fig. 5. Beginning the chore of removing old oil from the circuit breaker tank

Which Circuit Breaker Is Easier to Maintain: Oil-filled or Oilless?

In February we described the advantages of oilless circuit breakers over the oil-filled type. One of the biggest of these advantages is easier maintenance of the breaker. These pictures show why this is so

By W. B. WILSON * and JAMES ERWIN †

Fig. 2. Loosening tank bolts with complete breaker on handling carriage

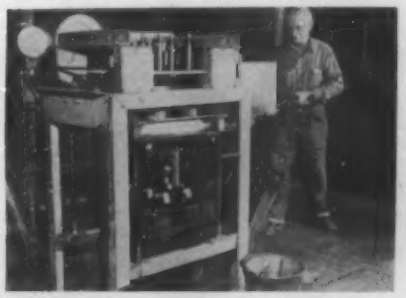

Fig. 3. Lowering tank alone on to carriage, leaving breaker in position

MAINTENANCE is a most important item to be considered in the selection of power circuit breakers which are so vital to the profitable operation of our American industry.

The difference in man hours required to inspect and maintain the breakers is very important. Estimates from various maintenance superintendents indicate that about 3 times as much time is required to maintain an oil breaker as is required for an oilless breaker. In a repetitive duty application, maintenance time for the oil breaker will thus be many times that required for an oilless breaker. In addition, there is often more of a tendency in some plants to delay inspections of oil breakers than in the case with the oilless type, due to the oil-handling problem, even though a regular preventive maintenance program is scheduled. On the other hand, inspection and maintenance of the oilless breaker is a clean and relatively easy job which is not looked upon with disfavor by service men.

The problem may be rightly considered one of proper management, but advantage should always be taken of every opportunity to promote workers' interest in systematic inspections.

Due to design characteristics, most oil circuit breakers require a handling carriage, and all require an elevating rack for de-tanking. The following typical photographs outline the steps necessary for inspection and maintenance of the oil breakers. These pictures are not intended to show exactly how the work is done in every case, however, it is believed that they are typical.

Figure 1 shows the handling carriage being rolled into the metal-clad unit. Tank bolts are loosened in Fig. 2, and in Fig. 3 the breaker is being de-tanked.

In Fig. 4 the main contacts of the breaker, normally immersed in oil, are shown being cleaned and adjusted.

In Fig. 5, the task of removing the old oil begins. Figure 6 shows the baffles being removed for cleaning. Figure 7 shows the cleaning up operations.

* Industrial Engineering Section, General Electric Co., Schenectady.
† Medium Voltage Switchgear Dept., General Electric Co., Philadelphia.

Fig. 6. Removing insulating barriers that separate main contacts in the tank

Fig. 7. Cleaning the insulating barriers before putting new oil into the tank

Fig. 8. With cleaned barriers in position, the tank is filled with clean oil

Figure 8 shows cleaned baffles back in place and new oil being replaced ready for re-assembly of the breaker.

No handling carriage or elevating rack is required for many present day oilless breakers. After the breaker has been lowered for inspection, it can then be rolled out of the switch-gear on the truck-type wheels which are an integral part of the breaker element. The lowered breaker is shown ready for removal in Fig. 9.

To expose the main contacts and arc chutes for inspection, the only operation required is to remove the box barriers as shown in Fig. 10.

Measuring contact gap is shown in Fig. 11.

Oiling the operating mechanism, as shown in Fig. 12 is essentially the same for the oil or the oilless breaker. The solenoid control relay is conveniently located on the frame of the removable oilless breaker element so this important device can be inspected and maintained while the breaker is out of its housing.

The simple job of cleaning the arc chute barriers is illustrated in Fig. 13.

We have made clear that the oilless breaker is suitable for any application where indoor oil breakers might be considered — its greater capacity for repetitive duty, its elimination of the undesirable features of oil and its ease of inspection and maintenance make this breaker and its associated equipment ideal for any industry.

The importance of maintenance for all types of apparatus cannot be stressed too highly. That apparatus for which the required maintenance work is simplest and cleanest and can be performed in the minimum time is most likely to receive the best attention. The oilless breaker has an important advantage over the oil breaker in this respect.

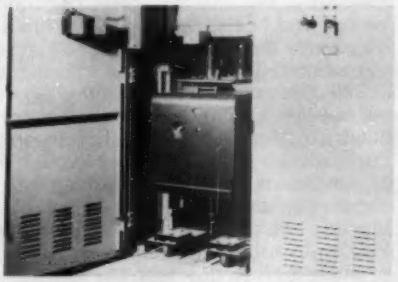

Fig. 9. Oilless breaker in lowered position ready to remove for inspection

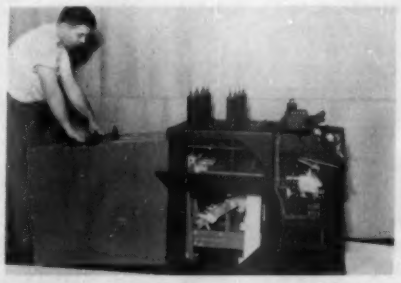

Fig. 10. Removing breaker box barriers to permit inspection and maintenance

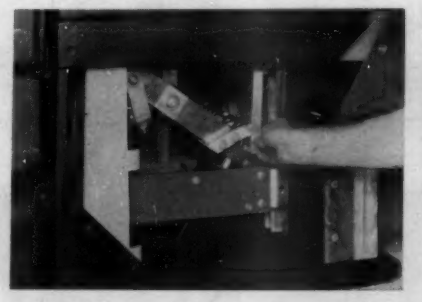

Fig. 11. Measuring the gap at primary contacts of an oilless circuit breaker

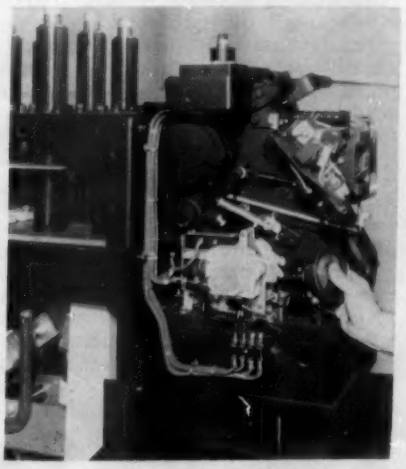

Fig. 12. Oiling the solenoid operating mechanism bearing on oilless breaker

Fig. 13. Cleaning inside surfaces of arc chute barrier for oilless breaker

Which Condensate Pump Control Is Best?

This is a discussion of the three most popular methods of condensate pump control in the U. S. today. Though it is brief, enough information is given to help you decide, "Which is best?"

By J. WYLLY KECK, JR.*

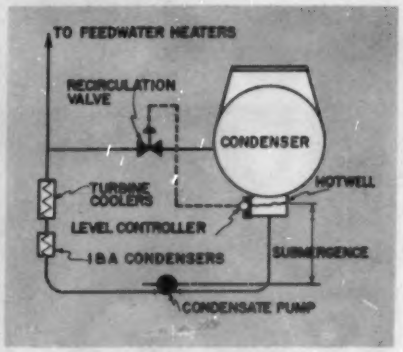

Fig. 1. Schematic diagram of recirculation condensate control arrangement

ALTHOUGH condensate pumps handle relatively pure water at about room temperature and only moderate pressures, they often constitute one of the most difficult problems encountered by power plant operators. Experience has indicated that many centrifugal condensate pump troubles are a result of incorrect pump and control applications. Some of the fundamentals of centrifugal condensate pump control will be discussed in this article. The discussion will be limited to submergence, recirculation, and throttling control methods which are currently popular in the U. S. although other schemes including adjustable diffuser casing vanes and variable speed drives have been used.

Submergence in this discussion is defined as the vertical distance between first stage impeller centerline and hotwell water level. Submergence is an approximation of the more precise term net positive suction head (NPSH). NPSH, in turn, is the total suction head in feet of liquid (absolute) referred to the first stage impeller centerline, *minus* the vapor pressure corresponding to the temperature of the liquid, *plus* velocity head at pump suction. When condensate leaving the condenser is exactly at the saturation temperature corresponding to the condenser vacuum; the prevailing pressure (or vacuum) is equivalent to the vapor pressure corresponding to condensate temperature. Therefore, in condensate pump service, the difference between submergence and NPSH is due only to suction pipe friction losses and existing velocity head which are negligible in properly designed installations.

The performance curves for a typical centrifugal condensate pump are illustrated by Fig. 2. Note the drooping characteristic of the head-capacity curve and the rising horsepower curve. For a particular pump operating at constant speed, a definite minimum submergence is required to produce a given flow into the impeller eye. When pumping capacity tends to exceed a value corresponding to the existing submergence, there is observed a distinct drop or break in the head-capacity and horsepower curves. In Fig. 2, the minimum allowable submergences for various flow capacities are indicated for the particular pump illustrated.

System head is the total head required at the pump discharge connection to produce a given flow of water through the pump discharge piping and heater system. System head is, therefore, a function of the piping and heater system and is completely independent of the pump characteristics. In Fig. 3, a typical system head curve has been superimposed on the ordinates of the pump head-capacity curve. It is apparent that system head and pump head are equal at point A only. At all other points to the left of point A, pump head exceeds system head. Now it is clear that the control problem resolves into selecting some means of balancing pump head and system head at any capacity up to that corresponding to point A. Obviously, the pump must be selected such that point A corresponds to a flow rate somewhat in excess of maximum flow into the hotwell.

* Consulting Engineer, Atlanta, Georgia

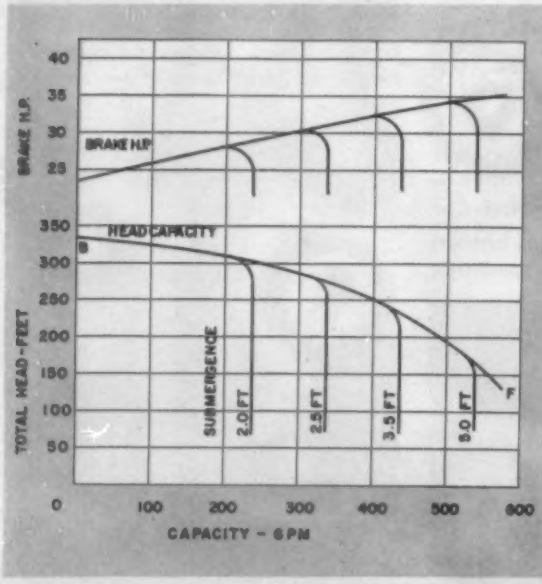

Fig. 2. Typical performance curves for centrifugal condensate pump, emphasizing submergence break points (curve droop)

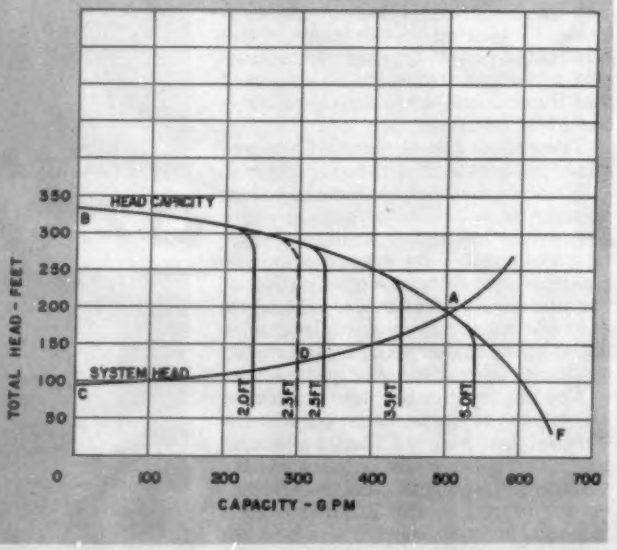

Fig. 3. Typical system head curve which has been placed on a corresponding head-capacity scale (back-pressure)

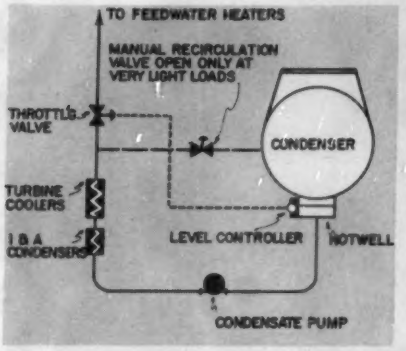

Fig. 4. Schematic of throttling control arrangement (manual recirculation valve)

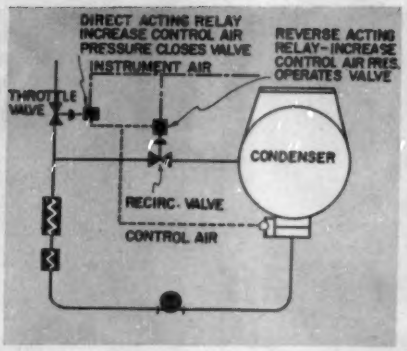
DIRECT ACTING RELAY INCREASE CONTROL AIR PRESSURE CLOSES VALVE
INSTRUMENT AIR
REVERSE ACTING RELAY - INCREASE CONTROL AIR PRES. OPERATES VALVE
THROTTLE VALVE
CONDENSER
RECIRC. VALVE
CONTROL AIR

Fig. 5. Automatic throttling and low-load recirculation from a level control

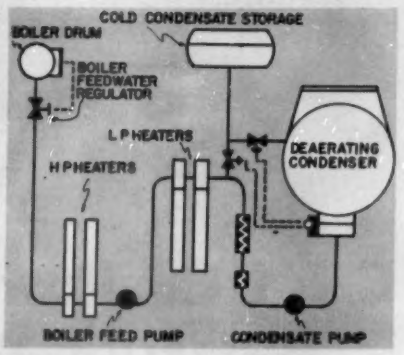

Fig. 6. Automatic throttling control, without deaerating heater in the cycle

The simplest method of bringing pump head and system head to equal values for various flow rates would be to do without any controls whatsoever, and allow the hotwell level to vary according to submergence requirements of the pump. For example, assume in Fig. 3 that condensate is entering the hotwell at the rate of 300 gpm while submergence is only 2.0 ft. Clearly the pump can handle only 236 gpm at 2.0 ft submergence, which means that the hotwell level must be rising. When the level has reached a point corresponding to 2.3 ft submergence, the pump will handle 300 gpm and flow from the pump will equal flow into the hotwell with the pump stabilizing operation at point D.

Cavitation, which is the formation and collapsing of steam bubbles, occurs at all times when the pump is not operating along base curve B-F. Operators are familiar with the noise, vibration, and impeller vane pitting resulting from cavitation operation of pumps. Under submergence control, the pump operates continuously in a cavitation condition. This fact and the necessity for a deep hotwell to allow wide level fluctuations are the main reasons why submergence control is not often used for other than the smallest installations.

Recirculation of condensate is a fairly popular control method and is shown schematically in Fig. 1. The control valve is actuated by a hotwell liquid level controller to maintain a constant level at all loads by recirculating condensate back to the hotwell. Recirculating condensate reduces the system head curve. Figure 7 illustrates a new system head curve, C-H, which results from a particular valve opening necessary to deliver 300 gpm net to system. The new system and pump head curves are equal at point H with 610 — 300 or 310 gpm being recirculated to hotwell. If available submergence were limited to 5.0 ft, the pump would operate at point F under cavitation conditions. Also note that the total amount of water being pumped increases with decreasing load.

Automatic throttling control is illustrated in Fig. 4, and is used to raise system head to equal the pump head at a given system flow rate. The throttling valve is actuated by a hotwell level controller to maintain a constant level by artificially increasing the system head (see Fig. 8). Assuming that the pump is installed with submergency sufficient for full load operation, the throttling valve assures that the pump remains on curve B-F at all loads. Reference to Figs. 7 and 8 show that required horsepower for throttling control is much lower than for recirculating control.

At turbine loads less than about 10 per cent of full load, condensate must be recirculated to the condenser to provide adequate cooling for the steam jet air ejector inter- and after-condensers, turbine oil cooler, and hydrogen cooler. Generally, a manually-operated recirculation valve is found to be satisfactory although thermostatically operated valves have been used successfully for automatic low load recirculation. This choice is usually left to the designer.

Another scheme for automatic throttling and low load recirculation has been *continued on page 86*

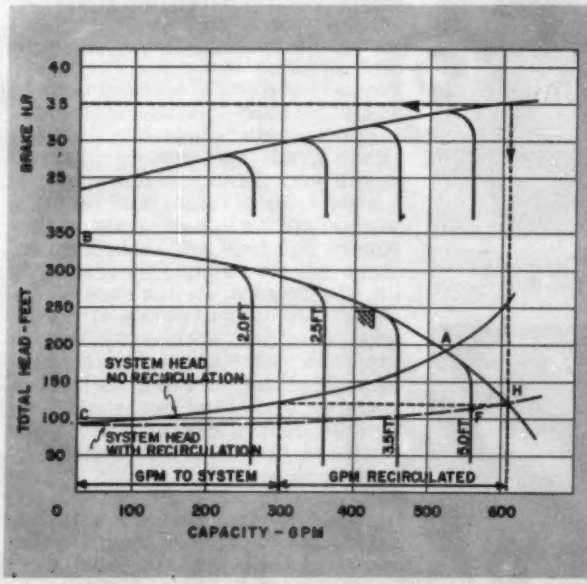

Fig. 7. Head-capacity and system head curves showing effects of operating with (dotted line) or without recirculation

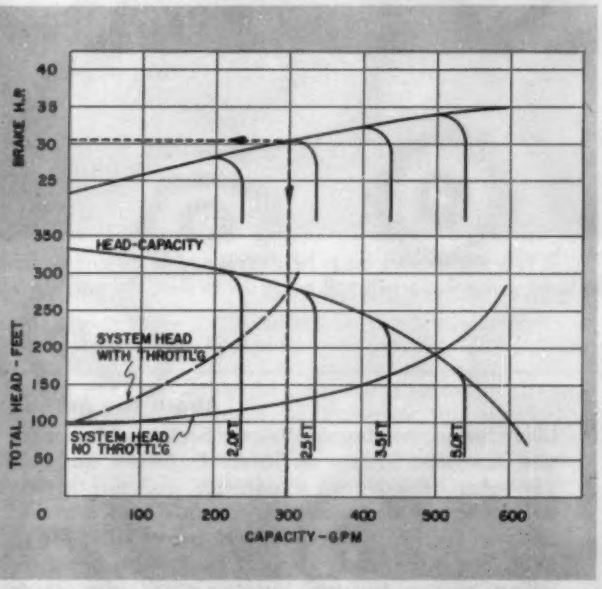

Fig. 8. Head-capacity and system head curves showing effects of operating with (dotted line) or without throttling

C. E. I. Co. Power Men Work Smarter, Not Harder

Work simplification program of Cleveland Electric Illuminating Co. leads its Power Production department to break record, with 101 proposals in a month, to ease work, improve operation. Here are many of their ideas, as put into effect in their plants. Future article will tell how work simplification can be taught to power engineers

By LILLIAN STEMP

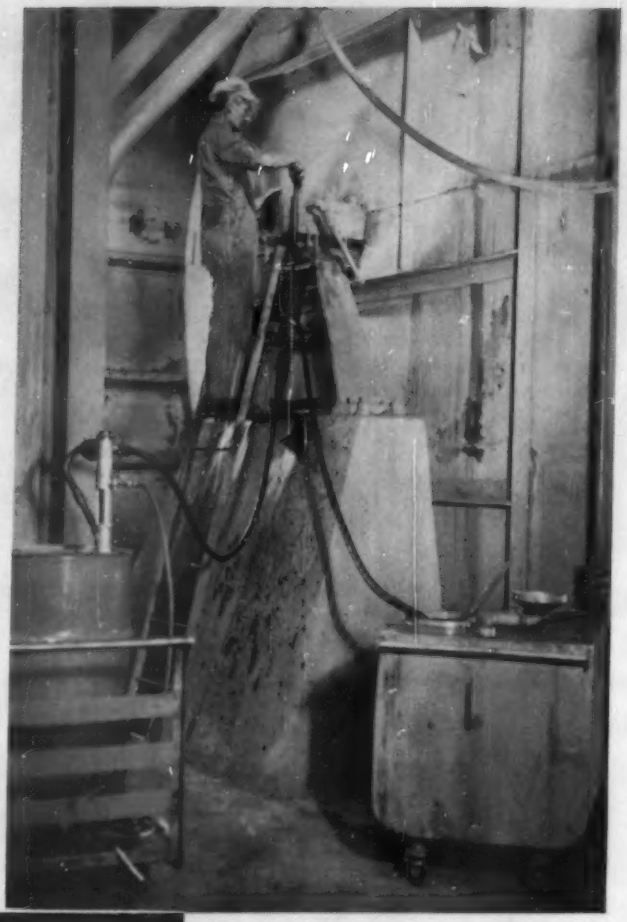

Fig. 1. Joe Kostohryz uses system proposed for changing oil in fan bearings

Fig. 2. F. J. Malak uses gage he developed to determine amount of hard surfacing to build pulverizing mill roll back up to size. He also developed the flux holder

CLEVELAND ELECTRIC Illuminating Co. was among the first of the public utilities to explore and embrace work simplification training (as taught by Allan H. Mogensen) as a means of doing work easier and smarter. As a result, every segment of the organization has developed improvements that effect savings in space, labor, time, injuries, materials and costs. The Power Production group is no exception. In fact, it has made spectacular progress. In one record-shattering month, Power Production personnel turned in 101 work simplification proposals.

One of the advantages of having a work simplification program is that once it has been established, it imposes the responsibility for promoting its effectiveness. In the case of the Power Production people at Cleveland Electric, work simplification proposals were slow coming in at first. The idea of easier and better ways of work somehow seemed remote to Power Production and in the minds of the men was relegated to "other departments, other activities."

Some months went by with few visible signs of work simplification improvements, until the staff technical specialist, G. H. Kelsey, who was also chairman of the departmental work simplification committee,

About the Author

Lillian Stemp, member of Western Society of Engineers and American Society of Safety Engineers, has had 22 years of industrial experience and has written several safety and maintenance books and manuals. She won the 1953 award for best paper submitted to WSE. She is a vice-chairman of the Printing and Publishing Section, National Safety Council, also serves on an American Standards Association Committee

Fig. 3. Steve Zver demonstrates C. Parker's idea: sleeve on each FD fan base, hook for chain hoist moved to any fan

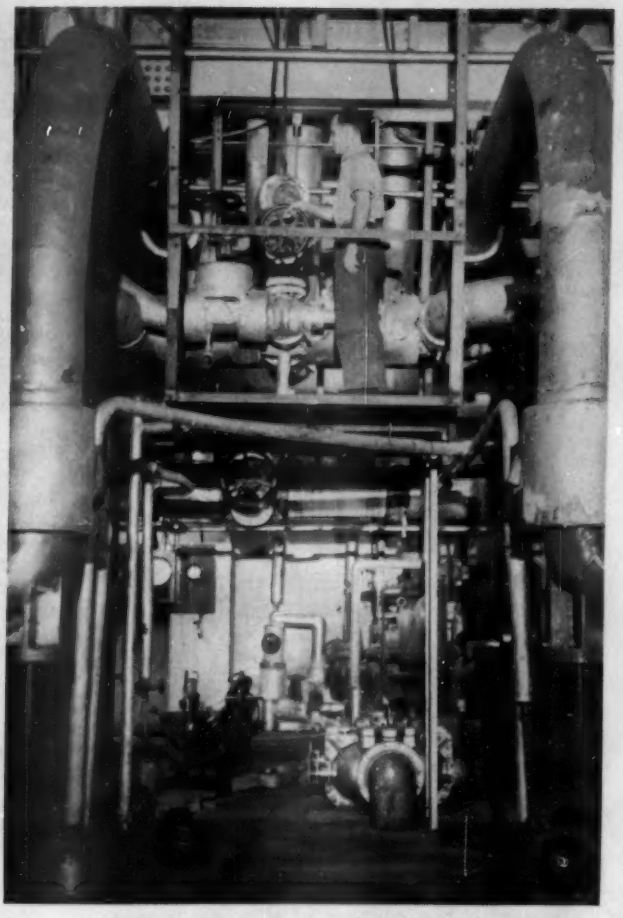

Fig. 4. Walter Kramer operates hard-to-reach steam valves from platform built in style suggested by John McBennett

was asked to stimulate interest. Mr. Kelsey reasoned that if the Electrical Department of Cleveland Electric could be so prolific in their work simplification proposals, there was no reason why the Power Production group could not do equally as well. He attended each management refresher meeting and told the groups what was expected.

How to Stimulate

Pep talks of this nature can cover many approaches. There is always the example used by Wilfred A. Peterson: "You have a dollar. I have a dollar. We swap. Now you have mine and I have yours, but we are no better off. You have an idea. I have an idea. Again we swap. Now we both have two ideas. Both are richer. What you gave, you have. What I got, you did not lose. That is genuine coöperation."

Or there is the admonition not to save ideas but to "put your good ideas to work as soon as you conceive them, for then they strike you most forcibly and you will put most into their expression." To make sure that the ideas were not being saved, but would come out into the open, Mr. Kelsey contacted everyone in Power Production from the vice-president of power production and engineering on down the line. With each he left a work simplification proposal form and encouraged the personnel to turn in an idea before the end of the month. He even mailed a form to the general superintendent of steam power, who happened to be on vacation at that time.

Mr. Kelsey got coöperation, all right! In that record breaking month, Power Production not only beat Electrical but also increased the participation rate from 14.7 per 100 employees in the previous month to 24.4 per 100 employees in the month of the drive.

That work simplification principles can be applied to any type of work is certainly proved by the variety of proposals that are submitted by Cleveland Electric's Power Production people. Here are some examples:

Installation of ammeters above the starting switches in the control room was proposed by Kenneth E. Fenton, head boiler operator, Steam, at Cleveland Electric's Lake Shore plant. These allow the operator to discern changes in the load on the air heater motors. They also provide a better and easier way of warning the operators of any abnormal conditions.

J. F. Shipman, plant watch engineer of the Steam department, suggested installing pressure gages at the headers to eliminate all the walking back and forth between the headers and the old pressure gage location. When turbine or boiler steam headers are being cut back into service, it is necessary to check the rise in pressure periodically. The installation has been a real step saver.

Third example in the visual indicator category is that proposed by Amedeo P. Caravona, head boiler operator, Steam, at Cleveland Electric's 20th Street plant. By cutting off the smoke indicator pipe and making other minor changes, a draft has been created which keeps the soot from accumulating on the smoke indicator lens. The change eliminates the need for a man to climb a ladder at least once a day to clean the lens, thus improving methods and safety.

Coal Burning Equipment

Kenneth D. Buck, junior engineer, technical engineering, Lake Shore plant, designed an additional counterweight that was mounted on the scale beam to improve the method of compensating for changes in weight of the coal scale hoppers. This compensation is necessary because of the loss of weight of the hopper by the abrasive action of the coal.

Production was increased and working conditions improved when Dominic Ruggie, superintendent of the Lake Shore plant, proposed that a nipple and valve be installed in the

Fig. 5. C. B. Smoljak selects the right tool for the job from the mobile maintenance tool carrier that he proposed

hydrovac system of each boiler, along with an attached length of vacuum hose. This improvement eliminates having to pick up ash and refuse, put them in a wheelbarrow and then cart them to the sluiceway. The ash and refuse now pass directly to the sluiceway via the hydrovac piping.

Gage with the contour of a new pulverizing mill roller is now placed against a worn roll, Fig. 2, to determine the amount of weld metal required to rebuild it during the rebuilding process. This was the result of a work simplification proposal by F. J. Malak, of the Lake Shore plant Steam department. Rebuilding process was described in POWER ENGINEERING April, 1954, page 72.

Mr. Malak also proposed the design of a reversible flux holder from a 19-in. diameter, $\frac{3}{16}$-in. thick steel plate with two steel ring bands welded to the plate and used for welding on mill rollers.

Even clerical work was improved when R. W. Whitney, steam department at the Ashtabula plant, found that the car-dumper man could prepare a list of cars of coal sampled directly on a form which is then turned in to the office. Previously the list was made out and *then copied* onto the form by the office.

Easing Maintenance

It is possible to increase the length of service of power production equipment through good maintenance practices and to make the work of repairs easier through improved methods and tools.

Among the many work simplification ideas that improved the maintenance factor at Cleveland Electric's various power production facilities are these:

D. G. Allen, mechanical repairman at the Lake Shore plant, reports that "many times during turbine overhauls the heavy casing nuts on the under side of the turbine casing have to be removed while the metal is still hot. Because of the location, the men have to work in a crouched position. Using a small four-wheel dolly with a lever arm and shaft mounted on a swivel, the men can now remove the heavy casing nuts without strain and heavy lifting in an awkward position."

Another mechanical repairman, Richard A. Krajewski, suggested attaching a welding-rod container to each welding outfit to insure having the proper type of rod on the job and to make a safer place for carrying than a jacket pocket. A container is also provided for rod stubs which prevents having them scattered about the floor.

From the steam department at the Avon plant, Harry Steel proposed a steel plate with four adjustable casters, which has been made to hold the 80-lb turbine bolts when cleaning the threads. Formerly two men were used to hold the bolt against the wire brush wheel.

Special Tools

Also from Avon, E. S. Wisneski constructed a hacksaw handle from materials on hand which enables the saw to be used to better advantage when doing repair work in places too cramped for conventional hack saw frames.

Norman T. Palm (Steam-Ashtabula) suggested a special socket wrench, which is now used for renewing overload valves on the mechanical-drive turbines. Use of the wrench enables the work to be done without removing the steam gage and its stop valve.

Job of cleaning substation heating steam boilers has been made easier and has eliminated all the dust of the wire brush method, because P. E. Kaade suggested use of a vacuum cleaner for this work.

Earl L. Baldwin, plant operations engineer (Steam-Ashtabula) found a way to make the sweeping of a suction pan easier. Motorized reduction gears have been installed to operate the dredge suction pan both horizontally and vertically by mechanical means. This was formerly done by use of a hand-operated winch.

The lower 8 in. of a permanent grill of a tempering air duct was hinged and made movable. Now tramp iron and pyrites can be removed without unbolting the complete grill. This work saver was submitted by C. F. Mueller, senior engineer, Technical Engineering Department.

Machinist A. H. Stoos (Steam-Avon) reduced risk of damage through his proposal for proper maintenance on economizer tubes. When a cast-iron economizer tube splits, it is now plugged with a 2-in. pipe of the same length. The economizer is then used until enough tubes have been plugged to warrant replacement of all damaged tubes at one time. Formerly, each split tube had to be individually removed by breaking it with a sledge hammer. That method permitted possible damage to the header.

W. F. Sattelmeyer, assistant general superintendent, proposed that fabricated steel economizer tubes be made from 4-in. extra heavy pipe and used to replace ruptured tubes. Formerly, more expensive cast-iron tubes were used.

Induced and Forced-Draft Fans

Two employees of the Steam Division of the Avon plant worked out this proposal: "Instead of replacing the float liners on the induced-draft fan wheel every three years, a strip of steel is welded to the tip of each blade end and hardsurfaced. Other worn spots are patched with hardweld." This reduces the time of outage for the boiler and increases productivity, report G. S. Barr and H. C. Furniss, who proposed the idea.

D. E. Barnes (Steam-Avon) found an easier way to change oil in the induced-draft and forced-draft fan bearings. A 10-gal drum, with a base and funnel fastened below the drain, has been mounted on wheels and used for changing oil in the fan bearings as shown in Fig. 1. When the oil draining job is completed, the drum is wheeled to the elevator and taken to the basement and emptied. Buckets were previously used and had to be carried to the basement and emptied.

From the Steam division of the Canal Road plant, Clyde L. Parker came up with this idea, shown in Fig. 3: "A sleeve has been installed on the base of each forced draft fan turbine, which enables a newly constructed hook to be slipped in and used for removing covers and spindles. The hook will turn in the sleeve and allow either the cover or spindle to be unloaded."

Adjusting Burners

"Locating a stud bolt on the flange of the burners in a boiler house at the Avon plant provides a faster and easier method of adjustment. Formerly, the burners were adjusted by placing washers between the burner flange and the burner box to direct the flow." Boiler repairman Robert T. Ireland made the suggestion.

Use Head, Save Feet!

This slogan has motivated many people who have had work simplification training to propose ways of saving steps, unnecessary climbing, etc. For example, at the suggestion of John McBennett, head turbine operator (Steam-Avon), "a platform has been installed on the auxiliary steam header, making it possible to operate the steam supply valves without using ladders to reach them." See Fig. 4.

No straps, studs or wires are needed to bind this insulation to plain surfaces. Spray it on as shown and watch it foam up

Paint-on Insulation Foams to Thick Coat

Here is a real time-saver: a plastic insulating material that is sprayed on like paint and then foams up to form a thick insulating blanket. It works especially well where the surfaces are irregular

INSULATING a rough, irregular surface usually involves a lot of cutting and fitting, followed by fastening with straps, studs, fabric, or wire. A new product on the market eliminates all of this very neatly. You merely spray a thin coat of a viscous plastic material onto a clean (but not necessarily dry) surface and the material swells to 20 times the coating thickness. It holds tight without binding, and it conforms to valves, fittings and irregularities.

When first sprayed on, the coating resembles heavy varnish. Shortly afterward it begins to swell, and after 15 minutes it has set into a foamy, semi-rigid insulation.

It is claimed that this material, Poly-Cell, can be applied in any desired thickness after a little practice with a spray gun. Its most economical thickness is from ½ to 1 in.

It is believed that the adhesive quality of Poly-Cell will cut costs of applying it to large, unbroken surfaces — primarily because mechanical attachments are not required. Eliminating the typical stud will do away with the heat leakage attributed to such devices. One gallon of this material will cover about 100 sq ft when the desired thickness is ⅜ in. (after foaming). Greater coverage will result in thinner coats, and vice versa.

Characteristics reported for this material show the K factor (per in. thickness) to be 24, and a density of slightly more than 2 lb per cu ft. The upper temperature limit is 225 F, while the lowest thus far determined by test has been minus 40 F. It is believed that it will be effective at much lower temperatures, but this has yet to be tested out.

While Poly-Cell will melt and burn in the presence of flame, it will not support combustion and immediately extinguishes itself when the outside flame is removed. The liquid form contains no combustible volatiles, hence it can be sprayed near open flames without danger of explosion.

Another advantage given for this insulation is in the application of vapor or weather barrier over the outside surface. In this case, there is an additional saving attributed to the elimination of the tack coat and membrane. If the insulation is to be uncovered, it is possible to specify a color additive for the liquid to produce any desired color coding or decorative coloring after foaming. Furthermore, the complete absence of joints eliminates the need for membranes to bridge these joints which would otherwise expand and contract continuously.

At the present time, the manufacturer plans to have its own crews make all field applications of Poly-Cell. This, presumably, is to insure that the early applications are properly made so as to encourage wider acceptance of a new product. The company men are familiar with the operation of the Poly-Cell spraying machine and will train other operators in the industries they serve.

If you want more information on this interesting product, write to the editors on your letterhead or jot Poly-Cell on the pre-paid post card elsewhere in this issue.

Fig. 1. These gleaming buildings at Kaiser's Chalmette Works each house 40 gas engines and generators to supply 100,000 kw of dc for plant process use

Kaiser's Big Chalmette Plant Solves Its Engine Problems

In three years of operating radial gas engines, Chalmette Plant power men come up with answers to such problems as wobbling engine foundations, too-rigid manifold design, and generator brush life

Fig. 2. A battery of the 11-cylinder Nordberg gas engines in Engine Room No. 1. Engines are individually governed for constant speed by a load-limiting device

By E. F. BOOBYER*

THE POWER FACILITIES at the Chalmette Works of Kaiser Aluminum & Chemical Corp. represent the expeditious use of several types of prime movers and distribution equipment to satisfy the heavy demand for d-c and a-c power required to produce up to 400,000,000 lb of aluminum a year in the largest aluminum plant in this country.

Electric power is produced at Chalmette by, essentially, two plants: a steam turbine-generator plant and a radial gas engine plant. The gas engine plant, consisting of 80 engine-generator units housed in two buildings, is the subject of this initial article on the power facilities at Chalmette. Future articles will discuss operating experiences with the Rectifier Station, the Steam Plant, and the service facilities.

With the exception of the natural gas fuel, the Chalmette Works is self-sufficient. The power facilities provide d-c and a-c power, compressed air, domestic water, mill water, and process steam to the alumina reduction facilities. Ultimate capacities are:

Power, dc	387,000 kw
Gas engine plant	103,000
Rectified ac	284,000
Gross Power, ac	400,000 kw
Domestic Water	1,600,000 gal/day
Process Steam	20,000 lb/hr at 125 psig
Compressed Air	8,750 cfm at 115 psig
Mill Water	30,000 gal/min

*Power Manager, Chalmette Works, Kaiser Aluminum & Chemical Corp.

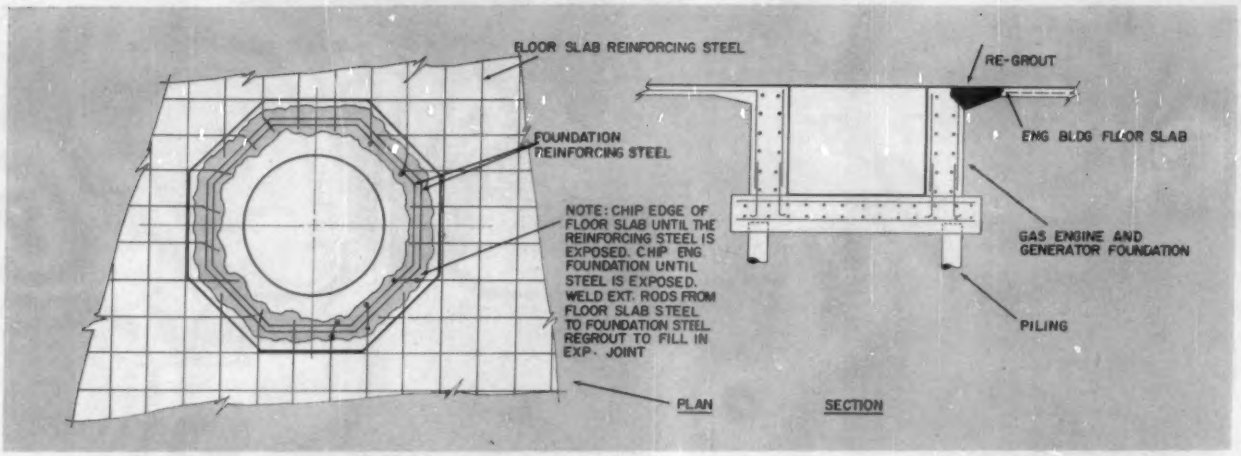
FLOOR SLAB REINFORCING STEEL
FOUNDATION REINFORCING STEEL
NOTE: CHIP EDGE OF FLOOR SLAB UNTIL THE REINFORCING STEEL IS EXPOSED. CHIP ENG. FOUNDATION UNTIL STEEL IS EXPOSED. WELD EXT. RODS FROM FLOOR SLAB STEEL TO FOUNDATION STEEL. REGROUT TO FILL IN EXP. JOINT
PLAN
RE-GROUT
ENG BLDG FLOOR SLAB
GAS ENGINE AND GENERATOR FOUNDATION
PILING
SECTION

Fig. 3. Shown here is the method used to overcome engine wobbling due to marshy subsoil of area. The reinforcement steel in the engine foundations was joined to the steel reinforcing the floor slab by welding in short extensions

These utilities are under the supervision of a Power Division comprising the Operating, Maintenance, and Technical Departments, each headed by a superintendent.

Kaiser Engineers, a division of The Henry J. Kaiser Co., were the engineer-contractors, and Kaiser Aluminum forces, in conjunction with vendors' service engineers, tested, regulated, and calibrated the power equipment prior to putting the facilities into operation.

The immediate need for power at Chalmette was too demanding to allow of long range planning and the engineer-contractor, after commencing design in February, 1951, was faced with the need of supplying the first 50,000 kw of dc as one block of power by November, 1951, to be followed by a second block of 50,000 kw of dc by January, 1952.

Gas Engines Meet Need

This need was met by the installation of 80 Nordberg type RTG, spark-ignition, gas-fueled, 11-cylinder, 2-cycle, 400-rpm, 14-in. bore, vertical radial engines, each coupled to a 1290 kw d-c generator (Fig. 2).

Engine Room No. 1 was ready to receive the first 40 engine-generators by early September, 1951. The engines and generators were individually shipped to the site completely assembled, ready for the installation and coupling. These were followed closely by the second 40 engine-generators for Engine Room No. 2. After an engine-generator was completely installed it was run-in by loading it through a water rheostat.

Since both engine rooms were in operation before completion of the central loading control facilities, initial operation was carried out entirely by manual manipulation of individual engine controls by an enlarged operating crew that incorporated operators destined for the Rectifier Station; at that time, this station was still in the design stage.

The major difficulty encountered in the Gas Engine Rooms was from engine "wobbling." This stemmed from the lack of secure engine foundations due to the consistently high ground water table and the unavoidably inadequate site drainage. The water table was within a few inches of the surface and the construction forces had not had time to cut the drainage system. Engine foundations were supported by friction piling in bottomless marsh land that was below the level of the adjacent Mississippi River during most of the year.

Engine Wobbling Overcome

The problem of "wobbling" engines was overcome by tying the engine foundations to the building reinforced-concrete floor slabs, as shown in Fig. 3, aided by the subsequent lowering of the water table through improved site drainage facilities.

The engines are housed in two separate engine rooms and each engine room supplies 50,000 kw dc at about 720 volts directly to a "potline" in the alumina reduction plant. Firing sequence of these engines is in rotation by cylinder number; reciprocating motion of the pistons and connecting rods is translated into rotary motion by the unique application of a planetary gear system that eliminates the conventional type crankshaft.

Each engine-generator is a self-contained unit, equipped with individual positive and negative breakers, local control, cubicle, jacket water pump, lube oil lump, lube oil sump, generator cooling fan, lube oil and jacket water cooler radiator with fan, scavenger air blower and fine air filter, ignition generator and lube oil filter. Such an arrangement allows maximum versatility within an engine room. All auxiliaries are powered by a-c motors supplied from the turbine-electric plant through a system of 13.8 kv, 440-v house transformers.

Excitation of the d-c generators is from a single source in each engine room. Motor-generator sets are used for this purpose and also for supplying motoring current to the generators through a separate starting bus during start-up of the engines.

Both engine rooms are slightly pressurized by water-washed air, supplied by a system of individual combinations of air washers and air supply fans located adjacent to the building walls. Engine exhaust gases are dispelled outside the building through individual aluminum stacks and mufflers, purged by used cooling air delivered from the engine radiator fan (Fig. 4).

All individual engine auxiliaries together with important operating functions, such as lube oil temperature, are interlocked to shut the engine down and open the appropriate breakers automatically in event of operating trouble or loss of any auxiliary.

Each engine is supplied with sufficient instrumentation to allow adequate scrutiny by the operators assigned to each engine room. In addition, centralized loading control for all 80 engines is housed in a separate control building, where a distribution operator can monitor the loading on each engine and manually or automatically adjust engine loads to satisfy a demand for standard voltage or standard amperage sendout from either engine room. *next page*

Fig. 4. Engine exhaust stacks and air intakes for oil, jacket-water cooling

Fig. 5. Close coupling between exhaust flange and header gives gasket trouble

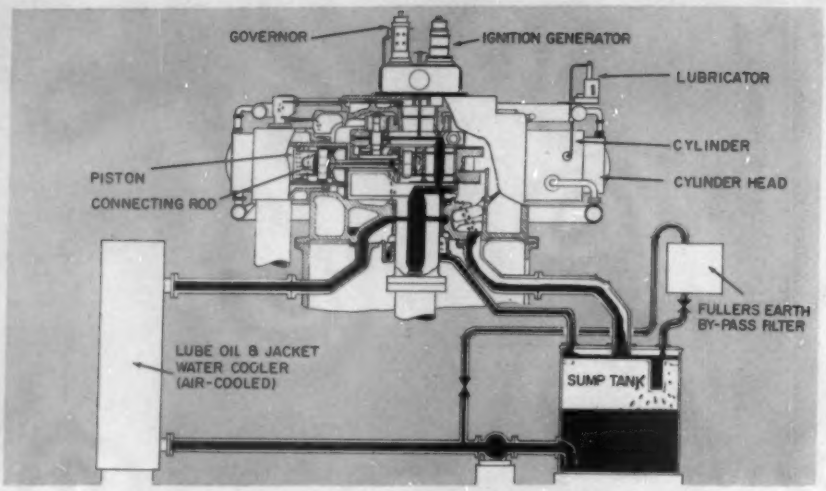

Fig. 6. Schematic diagram of engine lubricating oil system. Oil is not changed periodically; makeup is added and fuller's earth replaced after about 3000 hrs

Maintenance of the radial engines has been developed to a point where major routine inspections will probably be made at intervals of 20,000 hours, except in rare cases of forced outages from unusual causes. Piston-ring wear and bearing wear inspection will dictate this interval. The engines remain remarkably clean of carbon, and cylinder wear is at an extremely slow rate.

The major maintenance problem still not satisfactorily or economically solved is that of exhaust gasket failure. Exhaust temperature is not so much responsible for this as is the relative movement of the cylinder blocks to the single-piece exhaust manifold and the attached main exhaust trunk to the muffler (Fig. 5). The exhaust manifold and trunk present a massive assembly not capable of moving in rhythm with the slight cylinder block motion when the engine is operating. The best exhaust gasket life anticipated at this time is in the order of 8000 hours and such a life has been mostly due to the "slinging" of engine exhaust mufflers instead of the original method of firmly anchoring them in the stack structure.

Lube Oil Studies

Experiments with various types and grades of cylinder and crankcase lube oils are being pursued. At present, identical SAE 40 paraffin base oils are being used for both crankcase and cylinder lubrication. Cylinder lubrication is force fed at the rate of approximately 0.18 gallons per engine-hour. It is hoped that the average rate of 0.22 gallons per engine-hour now migrating from the crankcase to the cylinders can be reduced. A diagram of the lube oil system is shown in Fig. 6.

A hard carbon build-up has been experienced in the exhaust ports. This is abrasive by nature and could represent a limiting factor to the operating period between engine inspections. This carbon formation could become such a barrier to the free flow of scavenging air and exhaust gases that combustion, engine performance, and scavenger blower capacity would be impaired.

Use of detergents in the cylinder lubricants has failed to show an advantage over the solvent-refined, paraffin-based lubricants, inhibited against oxidization, that are in use. Thought has been giving to using a solvent-refined naphthenic base oil in the hope that the carbon resulting from the burning of such a lubricant in the cylinder will be so sufficiently fluffy and soft that it will not build-up on the exhaust ports.

Experiments with comformable oil rings are going forward in order to determine their performance as compared with that of the ordinary plain cast iron rings now in service. It is believed that a combination of plain and comformable oil control rings on the piston skirts may improve the control of oil migrating from the crankcase into the cylinders.

Lube oil in the crankcase system of these engines is not normally removed from the individual systems. Only make-up oil and an individual shunt-type fuller's earth filter (300 lb of earth) are relied upon to maintain the lubricant in sound operating condition. The shunt-type filter passes about 5 gpm of oil from the lube oil pump discharge at about 160 F back to the engine sump; a complete change of earth is required at intervals of 3000 hours of engine operation. The fuller's earth has not had any apparent detrimental effect upon the lube oil anti-oxidation additives; about 70 per cent of the inhibitor remains in the oil continually.

After about 16,000 hours continuous use of the crankcase oils, the average neutralization number is 0.12, the average viscosity (SSU at 100 F) is 795, the average IFT is 28–30 dynes/cm, there is only a slight trace of insolubles, and the carbon residual is averaging about 0.5 per cent. We do not consider color as being indicative of oil quality.

These two-cycle radial engines perform most efficiently at 100 to 105 per cent designed full load (1290 kw), and in an effort to maintain the best possible engine performance, a program of routine analysis of the ignition system and thermodynamic balance of all engines is enforced. Such scrutiny is made, while the engine is under load, by use of a specially designed Sperry "Engine Analyzer" incorporating an oscilloscope, vibration pick-ups, and ignition voltage pick-ups. This instrument indicates faulty elements in the ignition system and allows very accurate timing and fuel valve settings.

An economically useful life of about 12,000 hours has been experienced with spark plugs. After that period the plug is still generally sound but not capable of delivering a spark of sufficiently *continued on page 86*

Table of significant data on the gas-engine, d-c generator plant at Chalmette

Capacity of gas engine plant	103,200 kw dc
Avg. monthly engine room load factor	92.5 per cent
Avg. monthly engine-generator availability	98.0 per cent
Nominal engine-generator rating	1290 kw dc
Engine speed	400 rpm
Avg. monthly gross heat rate (high heat value) per kwh	11,900 Btu
Avg. monthly total lube oil use per engine-generator	0.40 gal/eng. hr
Nominal scavenger air pressure	2.2 in. water
Gas fuel pressure to engine	18 psig
Avg. heat value of gas fuel per cu ft	1117 Btu

Ingredients for Self-Sufficiency—Sludge Gas and Propane

The Joint Disposal plant of the Los Angeles County Sanitation Districts is unusually well integrated and self-sufficient. Some authorities believe this sewage treatment plant could continue to provide its essential services regardless of any local emergency

By JAMES JOSEPH

Fig. 1. New pump building houses five gas engines. Surge tower at left; jacket water radiator shows in foreground

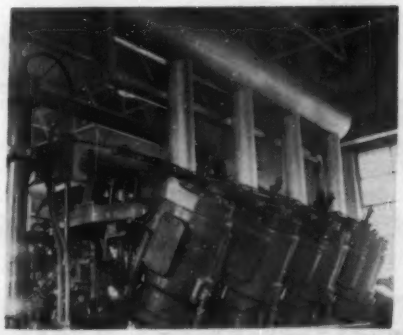

Fig. 2. Jacketed cylinders of pump engines which use sludge gas or propane

Fig. 3. Operator adjusts engine speed regulator to control pump rpm, delivery

THE LOS ANGELES COUNTY Sanitation District's Joint Disposal plant processes about 175,000,000 gal of sewage daily without any dependence on outside utilities.

The plant's power house operates on sludge gas, plus standby propane when necessary, and all water is drawn from a well on the plant grounds. No power lines, gas or water mains enter the plant from outside. The Joint Disposal plant is practically completely self-sufficient.

Typical of the plant's self-sufficiency is the new pump house equipped with five 4-cycle Ingersoll-Rand gas engines. These engines can operate either on raw sewage gas or propane, and are rated at 408 hp with a stroke of 13½ in. and a bore of 11 in. They drive mixed-flow pumps via right-angle gearing. Pump impellers operate at a maximum of 575 rpm, which corresponds with engine maximum of 450 rpm.

Function of the engine-driven pumps is to lift primary effluent into a surge tower, 54 ft above sea level, so that the effluent may flow by gravity to an ocean outfall about 7½ miles south of the plant.

Jacket water cooling is maintained at approximately 190 F and accomplished by a closed system for each engine. The two systems circulate the coolant through a single outdoor radiator which has five horizontal banks of fin tubes aerated by four horizontally-mounted axial-flow fans. A standpipe and float in the return lines provide necessary make-up water, although very small loss has been experienced. Each engine's water jacket has an electric immersion water heater in the incoming side and a thermostat in the discharge line. System circulation is maintained by two pumps directly coupled to 25-hp electric motors.

The new pump house is also equipped with a standby electrical plant; this is a 140-hp, gasoline-fueled Waukesha engine driving a 60-kw a-c generator at 1800 rpm. The engine is battery started. Should there be a failure of the three 800-hp gas engines in the main power house, the small pump house standby plant would supply the necessary electrical power to keep the water jacket cooling system operative and assure operation of essential plant pumping services regardless of the central power plant. For example, should sludge gas supply fail for any reason, the pump engines would be switched to propane and the standby electric plant started to supply the only electric power needed — that required to drive the cooling pumps.

An interesting feature of the pump engines is their variable-speed control, which can be set to govern engine speed between 450 and 225 rpm. The governor controls the mixing valve on the gas-air chamber of each engine. Thus, presetting the governor for a specific rpm automatically determines the discharge rate of the mechanically coupled pump. Air is supplied to the engines through oil bath air filters; gas, whether sludge or propane, comes from the digester tanks. When needed, the standby propane is introduced into the digesters for distribution to engines and boilers through piping which delivers sludge gas.

The plant's sludge gas (average) has been analyzed to contain:

Methane	67.5 per cent
Carbon dioxide	32.4
Nitrogen	0.041
Carbon monoxide	0.03
Hydrogen	0.02
Oxygen	0.004
Hydrogen sulfide	0.0043
Ammonia	0.00025

Since the heat content of the sludge gas is only 650 Btu, air-gas mixed propane is regulated to the same Btu rating before introduction into the digesters.

The Joint Disposal plant is further bolstering its integrated self-sufficiency by addition of yet another Ingersoll-Rand 800-hp engine to the main power house. The power house currently has two of these engines which have been in almost constant operation. The new engine will permit the scheduling of maintenance downtime for the original engines and also provide a standby for emergencies. Any two of these 800-hp engines, each driving a 560-kw a-c generator with outputs synchronized, can provide nearly 1200 kw at 60 cycles — sufficient to power all plant motors and utilities.

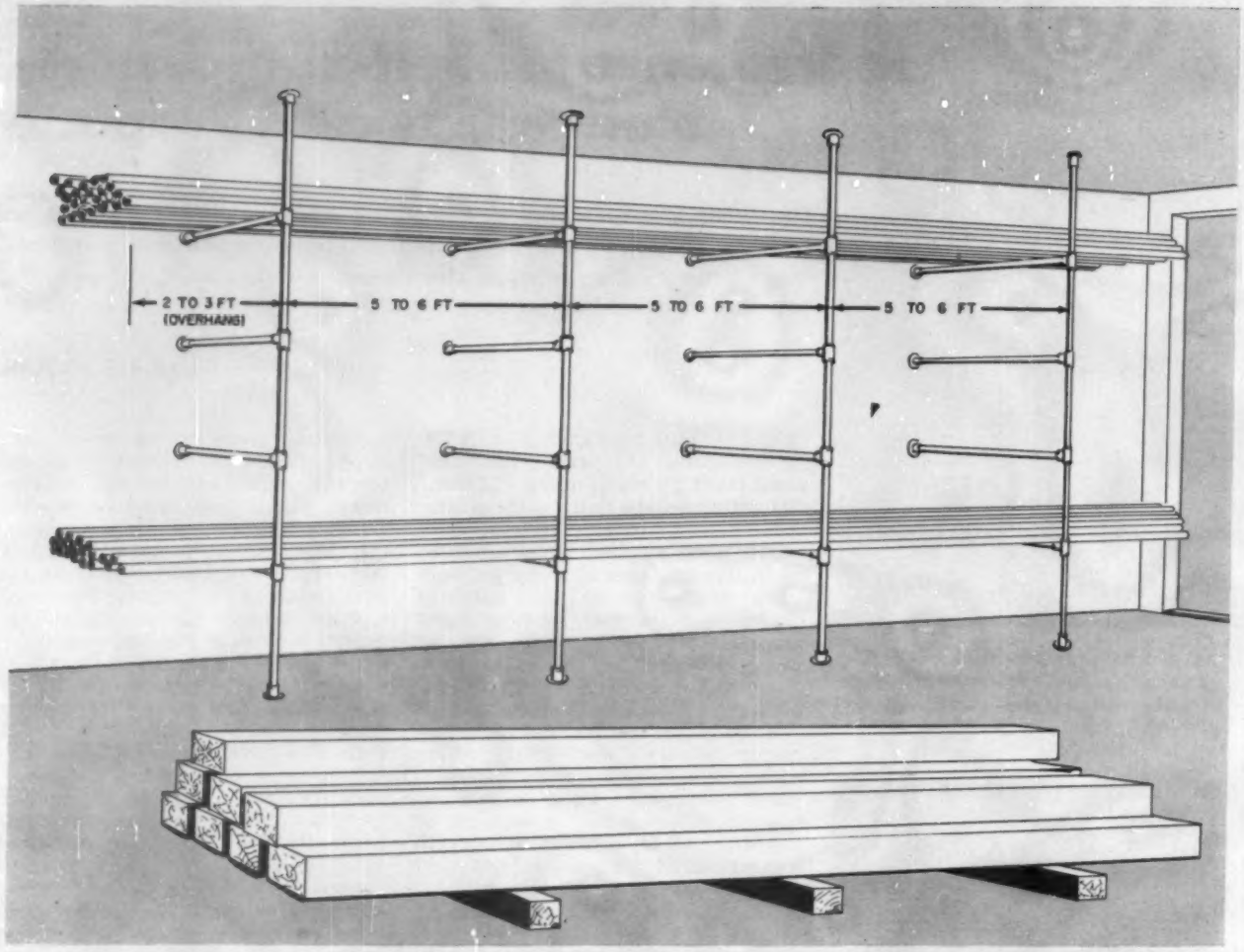

Fig. 1. Typical rack constructed of standard pipe and fittings for storing condenser and heat exchanger tubing safely is shown in top view. Bottom view demonstrates best way to stack packaged tubes so that air can circulate around boxes

Store and Handle Your Condenser and Heater Tubing Properly

Copper alloy tubing for use in power plant heat exchangers can be ordered as needed by large stations, or stored in the plant by a small station. Must be done right in either case and here's how

BY ARTHUR I. HEIM*

STORAGE, HANDLING AND replacement of copper-alloy condenser, evaporator, and feed water tubes present problems for engineers of large and small power plants alike. For this reason, the techniques of tube maintenance developed by one of the largest U. S. power companies over long years of experience can serve as a valuable recommendation for the entire industry.

Consolidated Edison Company of New York, with 500,000 condenser tubes in service at nine of its major power stations, is one of the world's largest users of heat exchange tube. And the company operates its condensers under some of the toughest conditions to be found anywhere.

Because salt water is taken from the rivers surrounding New York City, the utility company faces tricky tube corrosion problems. The water Con Edison runs through its condensers contains sewage and industrial wastes from hundreds of manufacturing plants. Due to action of tides, the waste and salt content of the cooling water varies from day to day. Furthermore, the water is different at each of the nine plants. Corrosion of the condenser tubes is a result of both chemical and erosive action which takes place for the most part at the inlet end of the condensers.

Screening the cooling water as well as chlorinating it with sodium hypochlorite or liquid chlorine is all that Con Edison finds it economical to do in the way of conditioning. The main emphasis is placed on the choice of the copper alloy used for tube.

Selecting Condenser Tube

After years of testing and experimenting with many different materials, Con Edison has standardized on condenser tubes of aluminum brass (76 per cent copper) and aluminum bronze (95 per cent copper). These alloys are also recommended by the Copper & Brass Research Association as combining the greatest resistance to corrosion with maximum thermal conductivity.

*Research Engineer, The Copper and Brass Research Association

There are two general systems for inspection of newly purchased tubes which should be considered; the first is suited to the company that buys tube regularly and in large quantities, the second to the one that buys smaller quantities less frequently.

Con Edison, for example, schedules its large tube purchases in advance of major plant overhauls, sends its own inspector to the tube plant to check the entire shipment before it is packaged. Inspections are thorough; they allow for either temporary or permanent rejection of tubes, listing reasons for rejection on a special inspection form. (See Fig. 2.) In addition, physical and chemical tests are run in the company's own laboratory.

Inspection Is Important

On-the-spot, pre-shipment inspection of this type eliminates manufacturers' responsibility for faulty tubes. As the tubes are shipped in original cartons, any damage visible on arrival at the plant clearly becomes the responsibility of the carrier.

For the small company that is not set up for full-time testing and inspection, on-the-spot testing at tube manufacturer's plant may still be practical. The best procedure for the smaller firm is to estimate long-term requirements, schedule ordering of the largest possible quantities, then employ an inspection service to check an entire shipment before it leaves the tube mill.

Obviously, if an outside inspection service at the mill is not used, the purchaser must remove the tubes from their original cartons upon arrival. In this case, Con Edison recommends that tubes be put into service as soon after plant inspection as possible, in order to minimize the problem of tube storage. The company buys large quantities in time for specific condenser overhauls, tries to eliminate storage time between arrival of tube shipment and actual shutdown for installations. During this time, if they have been inspected before shipment, the tubes are kept in the unopened cartons.

Replacement Policy

When an overhaul is completed, any tubes that may remain are placed in storage in the original cartons. Con Edison keeps these relatively few tubes until the next scheduled overhaul, at which time they are inspected and may or may not be used according to their condition.

Replacement practice at Con Edison is to plug faulty tubes rather than make individual replacements. The company has found that up to 10 per cent of a condenser's tubes may be sealed off without appreciable loss of efficiency. After 10 per cent of a condenser has been sealed off, the entire unit is scheduled for tube replacement.

Tube Storage

Recommended tube storage practice for small plants, where complete package-type condenser replacement is not economical, has been gleaned from manufacturers, plant engineers, and the Copper & Brass Research Association.

There are two schools of thought as to storage methods. Each has distinct advantages and some special disadvantages in coping with storage hazards (corrosion, physical damage). CABRA recommends that each method be considered carefully in view of conditions in a given plant.

The first method is to store tubes in the original shipping containers. Thus the tubes are physically protected from scratches, nicks, abrasions, and if container is wood, from kinks, bends and stresses. Wrapped tubes are also protected from the corrosive chemicals in fly ash, stack gas, coal dust, soot, etc., and from contamination by animal waste, acids, and the like.

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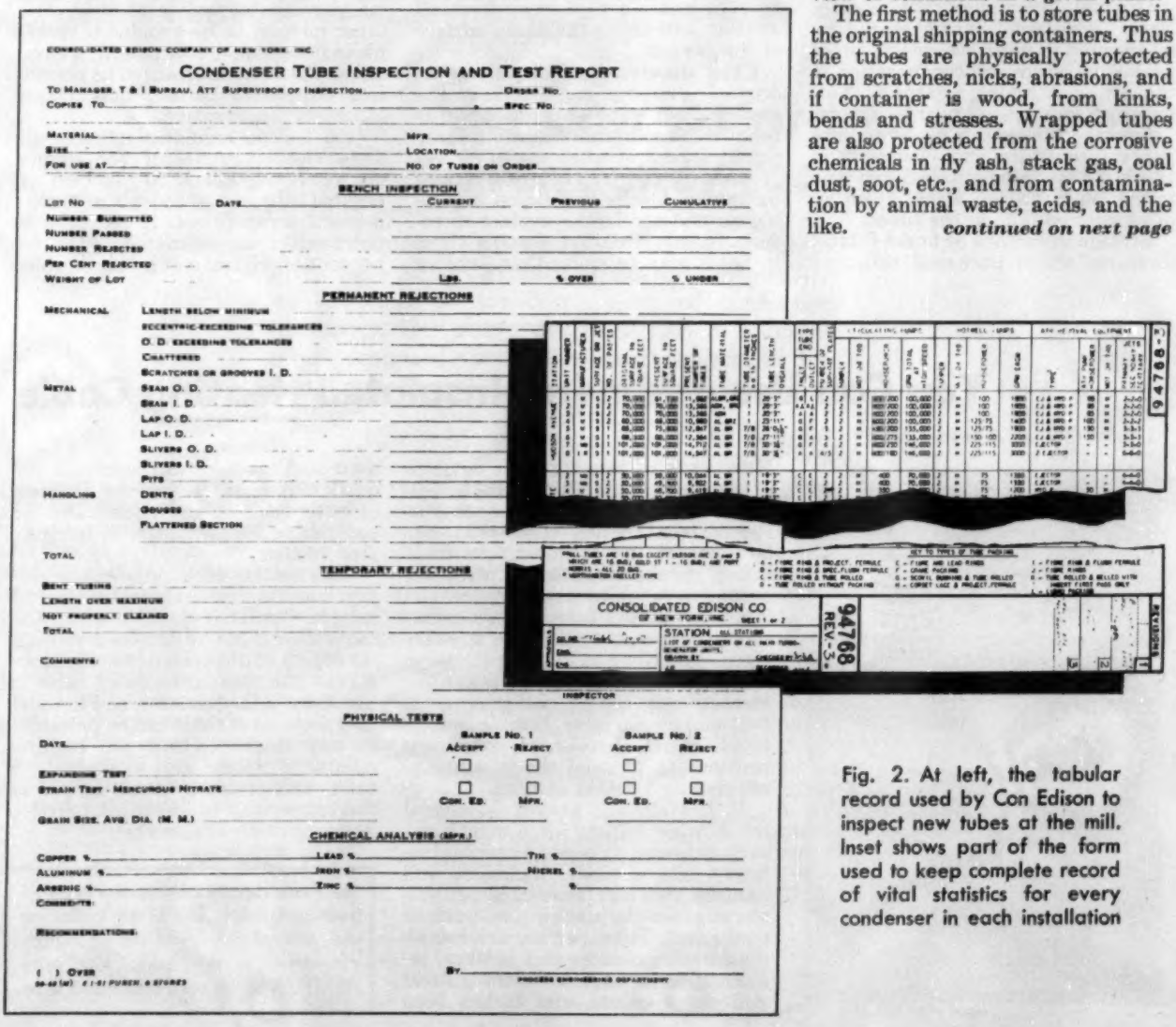


CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

CONDENSER TUBE INSPECTION AND TEST REPORT

To Manager, T & I Bureau, Att: Supervisor of Inspection — Order No.
Copies To — Spec. No.
Material — Mfr.
Size — Location
For use at — No. of Tubes on Order

BENCH INSPECTION

Lot No. ____ Date ____	Current	Previous	Cumulative
Number Submitted			
Number Passed			
Number Rejected			
Per Cent Rejected			
Weight of Lot	Lbs.	% Over	% Under

PERMANENT REJECTIONS

Mechanical	Length below minimum	
	Eccentric-exceeding tolerances	
	O. D. exceeding tolerances	
	Chattered	
	Scratches or grooved I. D.	
Metal	Seam O. D.	
	Seam I. D.	
	Lap O. D.	
	Lap I. D.	
	Slivers O. D.	
	Slivers I. D.	
	Pits	
Handling	Dents	
	Gouges	
	Flattened Section	
Total		

TEMPORARY REJECTIONS

Bent Tubing
Length over maximum
Not properly cleaned
Total

Comments:

Inspector

PHYSICAL TESTS

Date	Sample No. 1 Accept	Sample No. 1 Reject	Sample No. 2 Accept	Sample No. 2 Reject
Expanding Test	☐	☐	☐	☐
Strain Test - Mercurous Nitrate	☐ Con. Ed.	☐ Mfr.	☐ Con. Ed.	☐ Mfr.
Grain Size, Avg. Dia. (M. M.)				

CHEMICAL ANALYSIS (Mfr.)

Copper %	Lead %	Tin %	
Aluminum %	Iron %	Nickel %	
Arsenic %	Zinc %	%	

Comments:

Recommendations:

( ) Over

By

Process Engineering Department

CONSOLIDATED EDISON CO OF NEW YORK, INC. — Sheet 1 of 2 — Station — All Stations — 94768 Rev. 3-54

Fig. 2. At left, the tabular record used by Con Edison to inspect new tubes at the mill. Inset shows part of the form used to keep complete record of vital statistics for every condenser in each installation

Fig. 3. Installers at work on new Worthington condenser at Con Edison's East River Station. One of largest, unit has more than 18,000 aluminum brass tubes

Original wrappings are usually water "resistant", which should be interpreted to mean reasonably proof against moisture and condensation in the air, not water tightness. This moisture protection guards against "season cracking." The wrappings prevent moisture and chemicals in the air from causing corrosion and formation of brown, black, green, or other colored film on the tubes.

Storage in cartons or boxes is most desirable where packaged tube can be kept under a roof away from all weather and above the damp surface of the ground.

Chief disadvantage of storage in original shipping containers is the possibility of wood or cardboard material of the container becoming damp during transit or when stored on wet ground or floors. The case retains dampness, blocks circulation of drying air and accelerates surface corrosion. In this situation, leaving tubes in boxes may be worse than outdoor storage. When any damp shipping containers are detected, tubes should be removed immediately, thoroughly dried, and cleaned.

There are two main advantages in storing tubes unwrapped. First, this method permits inspection of tubes as soon as they are received. If there are any damages through shipping or due to faulty inspection, it is unfair to make claims for damage after years of storage. Second, unwrapped tubes permit free air circulation, avoid condensation and resulting corrosion.

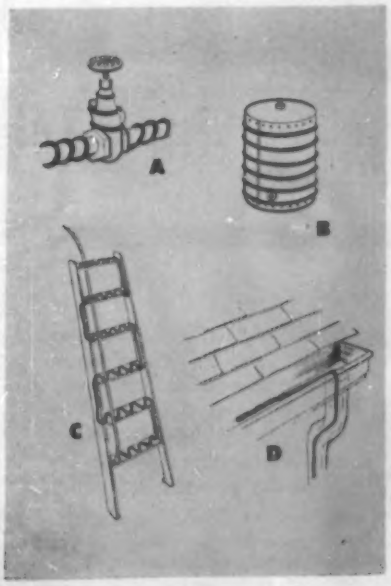
Conditions for successful storage of unwrapped tube should include racks in a dry, well-ventilated location where tubes are protected from weather, stack gases, coal dust, condensation, possible contamination by ammonia, ammonium compounds, or other nitrogen compounds. (Fig. 1.)

For protection against physical damage, storage racks should be arranged for uniform support of tubes at about 5 or 6 foot intervals. The number of layers of tubes on a given set of racks should be limited to avoid excessive weight on bottom tubes.

Storage out-of-doors is the least satisfactory method and should be used only as a temporary expedient for very short periods of time. Another method to be avoided if possible is storage under tarpaulin, which, unless the cover is arranged to permit free circulation of air, may cause excessive condensation.

Con Edison regularly salvages all un-serviceable condenser tube, counts on recovering about 50 per cent of original tube cost at today's new copper and scrap prices. If the tube is redrawable, an estimated 60 to 65 per cent of original cost is recoverable.

You Can Use a Mineral-Insulated Heating Cable



NEW TYPE of heating cable consists of mineral insulated copper clad cable containing copper resistance wires. Result is a heating cable that can be used at any temperature from 482 F to below freezing, wrapped around practically anything, can be immersed in any solution non-corrosive to copper, or enclosed in any material. According to the manufacturer it is heat-resisting, non-inflammable, mechanically strong, self-grounding, neat and unobtrusive, flexible, waterproof, chemical resistant, extremely resistant to thermal shock, and unaffected by weather or time.

It has already proved successful for a wide variety of applications, such as keeping viscous materials like heavy oils, asphalt, molasses, and paraffin flowing; removing or preventing ice formation on outdoor equipment, steps, walks, driveways, platforms, catwalks and ladders, removing snow and ice from gutters and down spouts, etc. It has been used to heat tank car contents for quick dumping, to prevent freezing of water seals on gas holders and for controlling ice formation in refrigerated rooms.

This heating cable, known as *Heatflex*, has the usual characteristics of mineral insulated cable, in which the outer sheath can be flattened without damaging or disturbing the resistance wires. The standard size of cable is less than ¼ in. diameter, and hot and cold sections of cable can be produced in any length to suit job requirements. Fittings are available for tanks and pressure vessels as well as for connection to electrical junction boxes or other enclosures.

For more details of this new type of heating cable, write to the Editor, or use one of the prepaid postcards elsewhere in this issue. Just write HEATFLEX on the card and mail it to us.

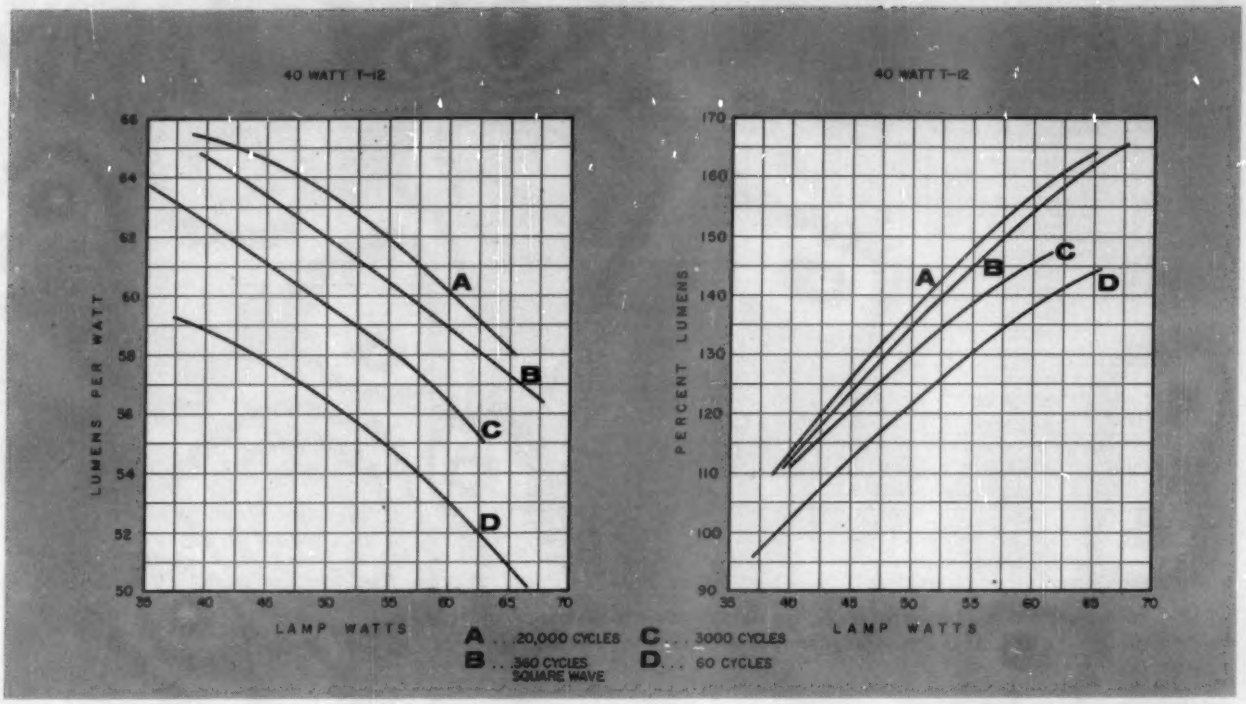


Fig. 1 (left) and Fig. 2 (right) show improved operation of fluorescent lamps at high frequencies, and also improvement gained by using square wave form current

Now You Can Afford to Multiply Frequency for Fluorescents

High frequency operation of fluorescent lamps gives them many advantages, but widespread use will depend on low-cost means of converting frequency. This article describes such a means — a new frequency multiplier — and summarizes the many advantages of high frequency operation

By J. H. CAMPBELL* and E. G. DOWNIE†

MUCH RESEARCH has been carried out in the last few years to find out what improvement in operation and economy can be gained by running electric discharge lamps at frequencies higher than 60 cycles. The practical objectives of this research are smaller, lighter, more efficient and lower-cost equipment. Results described below show that this work yielded all these anticipated advantages and many more.

Meanwhile, since new operating conditions for the lamps required corresponding changes in their associated equipment, even greater efforts were made to improve the 60-cycle circuits and auxiliaries. That these efforts were successful is shown by the fact that starters have been eliminated for most lamp types and Instant Start ballasts have been reduced in size, weight and cost. Further efforts in this direction face the law of diminishing returns unless radical changes in lamp design are made or a light source is developed which operates on an entirely different principle from those in present use.

This study and development work has resulted in a long list of benefits which may be summarized as follows:

1. Reduced weight, size and cost of fluorescent ballasts.
2. Reduced fixture weight.
3. Increased ballast efficiency (less heat loss).
4. Simplified fixture wiring.
5. Increased lamp efficiency.
6. Increased lamp loading for more lumens per foot of lamp.
7. Reduced ballast noise.

At frequencies beyond 300 cycles it is practical to use a capacitor as a ballast for the lamp. This provides an interesting comparison, since 360-cycle capacitor ballasts weigh only 3 to 6 oz and have losses of 1 to 3 watts. The same lamps at 60 cycles require ballasts of 3 to 10 lbs per lamp with losses of 7½ to 25 watts. Actually this amounts to a transfer of most of the weight and loss from the fixture to the area where the frequency converter is located. The fixture manufacturers will then obviously have much more freedom in the design of the lighting equipment. An experimental 360-cycle two lamp industrial luminaire has recently been designed which weighs 7½ lbs compared to 40 lbs for an equivalent 60-cycle fixture.

At present, there are two practical methods for changing 60-cycle power to a higher frequency.

1. Rotating Converters (motor generator sets 400 cycles or higher — sine wave).

*General Electric Company, Lamp Division, Nela Park, Cleveland, Ohio.
†GE Specialty Transformer Department, Ft. Wayne, Ind.

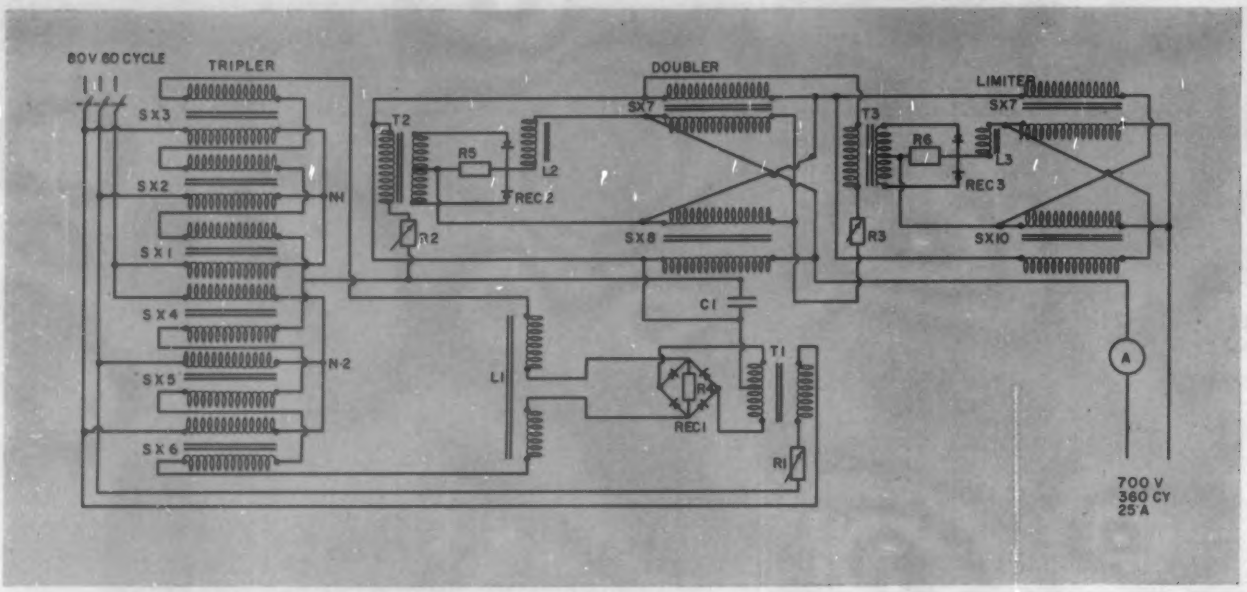


Fig. 3. Circuit diagram of frequency multiplier. Tripler section increases the input frequency from 60 to 190 cycles, and doubler increases the 180 to 360 cycles

2. Static Converters (Magnetic Frequency Multiplier — Square wave).

The rotary converter is well known and has been in use since the turn of the century, but it brings up maintenance problems not encountered in the usual building power distribution systems.

The Magnetic Frequency Multiplier was designed as a power supply for fluorescent lamps. It has no moving parts and can be treated as a transformer. A control on the panel makes it possible to regulate current to the lamp load for maximum flexibility. A unique feature of this circuit is the square current wave drawn by the lamp load. The output voltage, triangular in wave form, is applied to a lamp and capacitor in series thus producing a square current.

Figures 1 and 2 show important lamp characteristics for several frequencies with a sine wave current compared to a 360-cycle square wave. These results show that at high frequency a considerable increase in light output is possible. Operation of fluorescent lamps on a 360-cycle square wave is equivalent to 7000-cycle sine wave operation and allows for a lower cost distribution system.

Any gain or loss in over-all efficiency of the high frequency system will depend upon the losses in the converter as compared to the gain in lamp and ballast efficiency. With present information it appears that over-all efficiency will be the same as 60 cycles with converters of 5 kw capacity and possibly 10 per cent higher with converters of 25 kw capacity.

With only magnetic, metallic rectifier and capacitor components, the Multiplier converts 480 volts-60 cycles-3 phase power to 700 volts, 360 cycles, single phase, with automatic current limit and wide range of current control. The advantage of the Multiplier's square or flat-topped wave of current into a lamp load is shown in Figs. 1 and 2.

Figure 3 shows the basic circuit used in the Multiplier. There are three main elements: the first is a frequency tripler stage, in which the current is changed from 60 to 180 cycles, the frequency doubler stage, in which the frequency is changed from 180 to 360 cycles, and the current limiting and controlling stage.

Performance

The rated continuous output is 25 amp at approximately 700 v, 360 cycles, in a capacitive ballasted lamp load. Current control permits adjustment of output current between about 13 and 30 amp. The useful range may be limited by characteristics of the attached lamp load and Multiplier continuous current rating. The output voltage is enough to start 96 in. cold cathode lamps without auxiliary means.

Uncorrected power factor of the load drawn by the Frequency Multiplier is necessarily low, about 30 per cent lagging at full lamp load. This may be increased to 95 per cent or better by adding a Power Factor Correction Assembly, containing the required capacitors and filter reactors.

Efficiency of the Multiplier in transforming incoming line watts to actual lamp watts at full load is 72 per cent. Additional losses with power factor correction reduce this to 70 per cent. Over-all efficiency of light production with the recommended lamps is approximately the same as with lamps controlled by conventional 60-cycle ballasts.

Two converters of the type described above are in operation for experimental plant growth at the United States Department of Agriculture's Plant Industry Station at Beltsville, Maryland. Other similar special installations are being planned. Widespread use of this method of frequency conversion will depend on lower initial cost to give a more favorable comparison with our present 60-cycle system.

Author's bibliography on high frequency operation of fluorescent lamps available on request to the Editor. Just write FREQUENCY MULTIPLIER on one of the prepaid post cards elsewhere in this issue and mail it to us.

"You didn't have to warn me about getting too close, my nickname used to be Jimmy Durante."

Insulating Cement Cures Casing Erosion on ID Fan

By D. RUGGIE*

AT THE LAKE SHORE Plant of the Cleveland Electric Illuminating Company system there are a total of eight induced-draft fans, two for each boiler, located on the discharge side of the electrostatic precipitators. The fans are Sturtevant turbovane, size No. 1010, double width, double inlet with spiral inlet boxes, inlet-vane controlled, driven at 720 or 900 rpm and have a maximumg as handling capacity of 197,000 cfm in high speed.

Considerable difficulty was experienced with erosion of the periphery of the fan casings. Outages on large units were scheduled not oftener than every 6 months. But induced-draft fan casings would not last 6 months due to erosion; and this necessitated shutdown over week-ends for repairs.

In a search for an erosion-resistant material, the idea of lining the casing with a cement was decided upon. Super 3000 R & I cement was chosen for a trial. Engineers from the distributor and representatives of the manufacturer aided us in our experimentation.

How It Was Installed

On the first installation, expanded metal lath was fastened to the periphery of the lower half of the casing and extended in toward the shaft 8 in. on the sides. The lath was held by fasteners welded to the casing. Cement was applied to the lath so as to barely cover the surface of the lath.

On the sides of the casing the cement was feathered out about 4 in. from the edge of the lath. After two years' service there was little wear; and we decided to apply the lath and cement to the upper half of the casing also.

Application Improved

Since that original installation was made, the application has been improved by using a heavier expanded metal lath, which could be tack welded to the fan casing, eliminating the need for fasteners. The lath now used is Ryex standard expanded metal lath ¾ by 13 gage and 4 ft by 8 ft in size. Using low heat (100 amp) and 1/16 in. welding rod, the lath is spotted on 5 in. centers. At the edges of the inspection door, the lath is welded solid.

Our experience has shown that the cement should be used as it comes from the can, without adding water. It should be applied rough so that the surface just covers the lath. The cement should be allowed to room air dry 12 hr before putting the fan back in service.

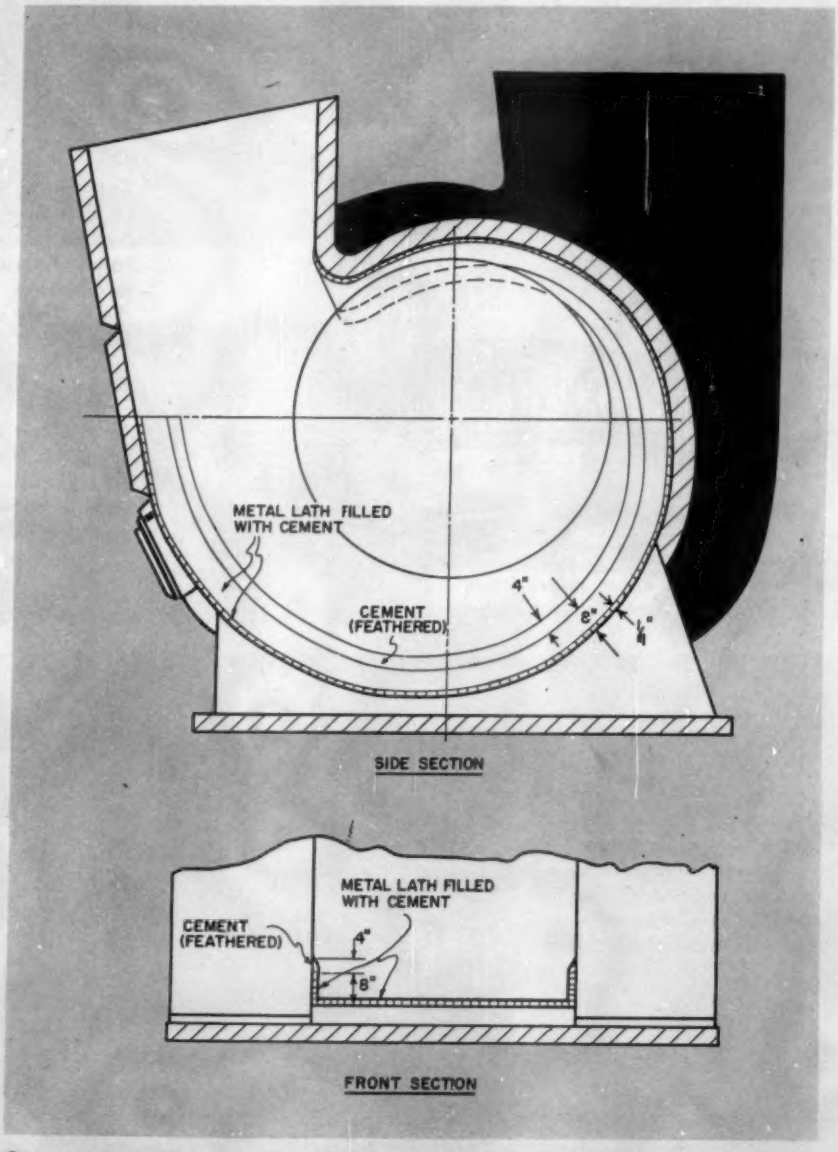
How Lining Cuts Costs

Since our initial installation, the fans on all the large units in the C. E. I. system have been lined with R & I 3000 cement, resulting in a substantial savings in maintenance cost. Where previously patches had to be welded on, and in some cases whole sections of the casing had to be fabricated, now it is only necessary to spend a few hours touching up the cement liner once or twice a year.

This same type of erosion-resistant surface has found use in applications on other pieces of equipment. The cyclone separator on a roll mill was insulated more than a year ago and shows little evidence of wear to date. At the present time, a test is being run on insulation applied to the inlet elbows and discharge ducts of the exhauster fans on Raymond bowl mills.

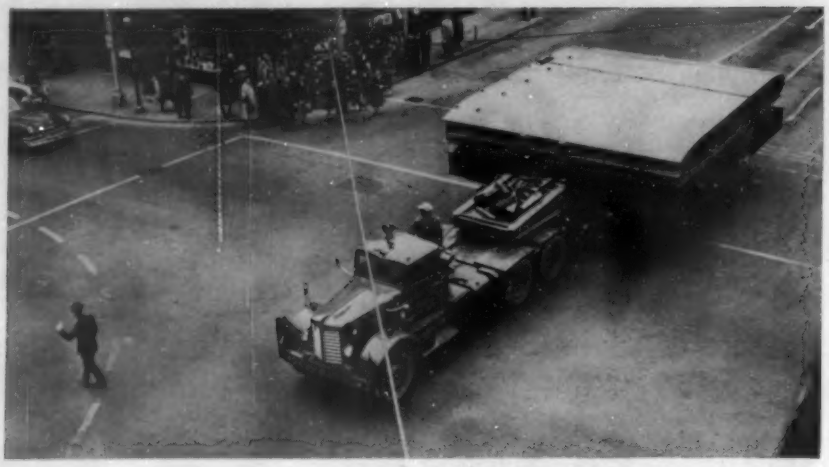
* Superintendent, Lake Shore Station, Cleveland Electric Illuminating Co.

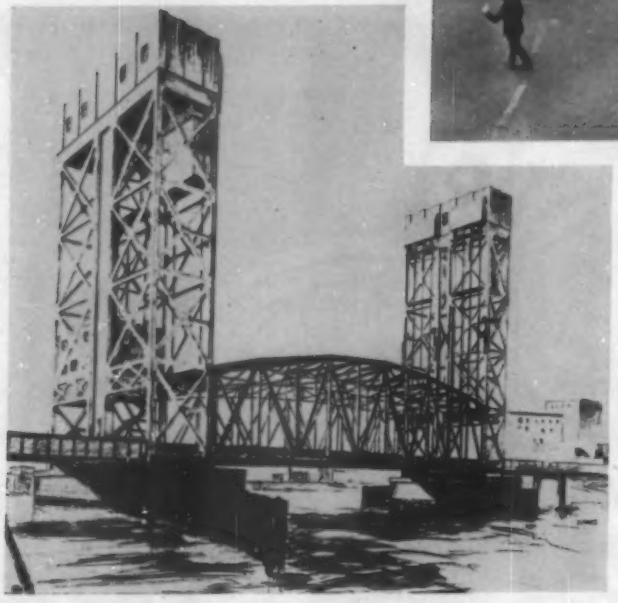
For more information about products used on this job, write the Editor, or write Fan Erosion on the prepaid post card elsewhere in issue and mail it to us.



Cross-sections through ID fan at Lake Shore Station, showing how insulating cement was applied on metal lath to stop erosion of induced-draft fan casings

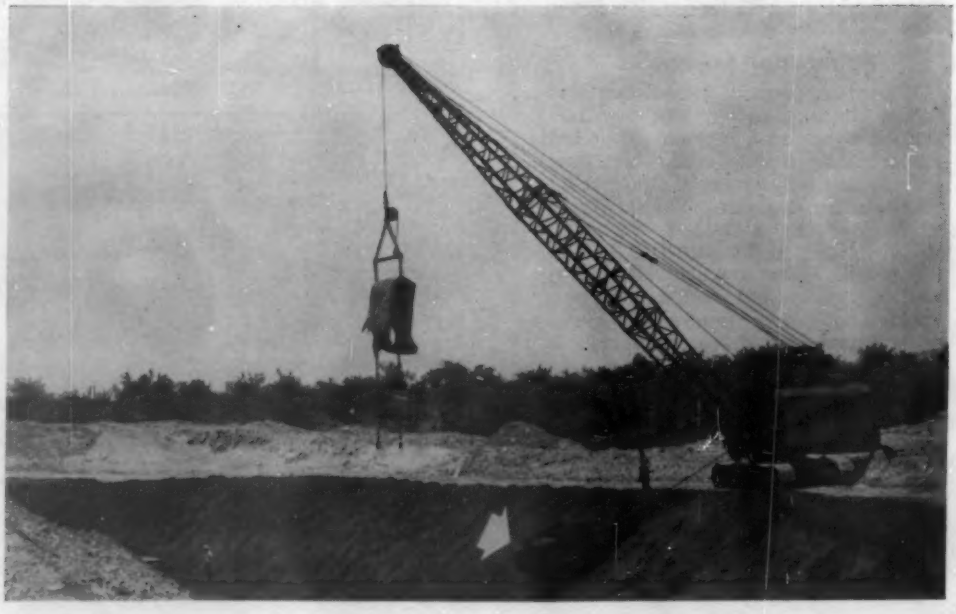
News Reel





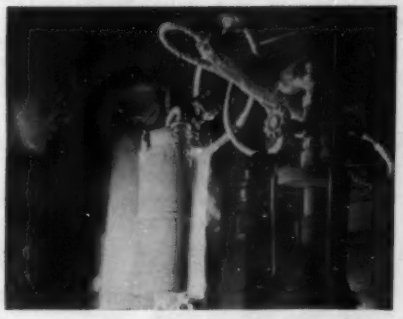
Two large lock gates for the New York State Barge Canal stop traffic on Erie Blvd., which was built on the bed of the old Erie Canal in Schenectady. Fabrication was in American locomotive's general welding shop there. They will be installed at Little Falls, N. Y., presumably before the canal opens for the 1955 shipping

N. Y. Central's new twin-lift bridge to span the Harlem River in 1956 actually consists of two nearly identical units. Each weighs 1400 tons, has own electrical lifting machinery by G. E.



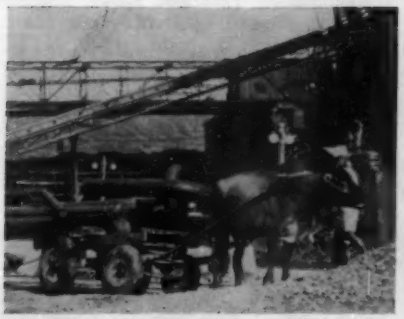
The Great Southwest is due for another drink as soon as this new irrigation canal is completed. A Hyster compacting grid roller is winched up the sides to form base (note the arrow)

Natural steam (left) comes roaring out of test wells on New Zealand's fabulous North Island. Capped wells have pressures as high as 300–400 psi, with flow pressures (at capacity) of 125–150 psi. Temperatures are about 480 F. Test rigs are drilling wells throughout the 20- by 100-mile volcanic area to determine its steam-making potential before making the hoped-for 50,000-kw turbine installation. Thirty holes have been drilled (see rig above); 20 made steam; 14 show promise for power

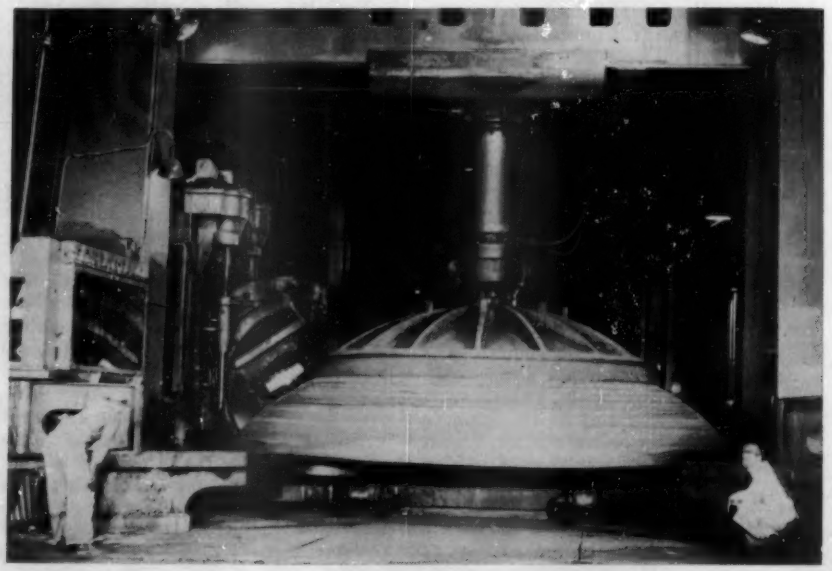


(Far left) Westinghouse wanted to know the stress-strain characteristics of some metals at low temperatures, so they built a helium-cooled, −452 F tension-test chamber to get the answer

(Left) Supersonic wind tunnels need aftercoolers, even when they are 70 ft diam. Trane made this one for Ames Laboratory at Moffet Field, California



(Above) Formosa will soon have two new steam-electric plants unless transport breaks down. We are assured that these oxen work as hard as their drivers



(Right) Conn. River Power Co. will use four of these 21-ft spun heads to test its Littleton, N. H., penstocks one time

Here's How You Can Be a Good Power Supervisor

By G. R. SETTERLUND

WORK DONE by power engineers is not particularly clean or soft. Much of the work entails the usual problems of coal, lubricants and water, and working hours seem specifically defined as those "when you're at home sleeping" or "the Sunday you had planned to take the family out on a picnic."

Success as a power engineering supervisor or foreman depends on two things over and above all else. Upon him depends the over-all efficiency of his department; he must answer to management, and, at the same time, recognize the individual rights of the employees under him. Neither of these essentials can be foremost, neither can be hindmost.

Two Types of Supervisors

Well do I remember a case when management selected a senior man to act as a foreman. He was well liked by his fellows. He had come up through the ranks, knew all the tricks of the trade. His success was foreordained. There was another part to the story, however. Rather than accept responsibility for an issued order, he would mutter to his men, "Well, fellows, you will have to do so and so. I don't like the idea myself, but the boss said it has to be done." What an easy "out" for the men and himself. If the order wasn't carried out, all he had to say was, "I told them to." His men wouldn't repeat his order, for he was too soft a touch. They liked to have him around.

Then there is the direct opposite who also came up through the ranks. Give him a stripe and he thinks he's a sergeant-major. He's the kind who will let his men grope around in the dark, endangering themselves and certainly doing a poor job, in order to save the company a set of flashlight batteries. Or the foreman who finds his coal handler gazing hopefully at the operating panel and then informs him that he's "being paid to handle coal and maybe someday the company will pay you to watch that panel."

How to Cure the Two Types

Each extreme case can be so easily rectified. When an order comes through, it must have some basis or the point would not have been raised. Think the thing over. Reason it out. See if the plan can be made workable. Then see your men. Explain the case to them, and give them all the available knowledge you have of the job. Find out the men's problems, their attitudes, their ideas for carrying out the job. Then set to it and give it a fair, honest try. If it proves impossible, see higher authority and thank the boys for their efforts.

The complete ego case is just as easily solved. If a man shows interest in things temporarily beyond his reach, take the time to help him out. You as a foreman or superintendent started out at the bottom, too, and if you had not been curious, you would still be at the bottom. You can easily rupture a man's initiative by quenching his desire to learn and broaden.

After-Hours Training

Training, welfare and career guidance of men, only a part of supervision, cannot be thoroughly handled in the confines of the working locale nor be embraced in the 8 short hours of the day. After-duty hours are considered a "must" in this day and age, for study, education and recreation.

You haven't time at work to bring the men's knowledge up, but if you offered one night a week teaching mathematics to those interested, or teaching English to our many new citizens, your class would be filled. Perhaps some of the boys are going to try for advanced state or municipal operating tickets. When they are operating a power unit, they have little time to try to ramble through formulas pertaining to rivet stresses or welded strains.

The exam may ask: What size trap would be needed for a 6-in. Schedule 80 steel pipe, steam (saturated) flow 30,000 lb per hr at 180 psig if the total length of pipe (uncovered) was 3000 ft and normal outside temperature was 64 F?

See what I'm driving at? Give the men a break if you are able. The better the men, the better the boss. I would personally rather have ten men to handle who I knew could do my job any day than one man who might be able to do my job if I taught him. A supervisor must have no fear of giving out knowledge in order to hold his position.

What Recreation Can Do

Recreation! Seldom can you display your ability to win and lose in a power plant. Get out with your men and relax. Skating, skiing, curling, bowling, and a dozen other sports can keep you on top of the world physically, and will do a world of good for *esprit de corps* (morale to you). Your men should recognize in you a good winner and a good loser at work and at play.

Three Basic Principles

Principles of successful supervision lie mainly in three basic areas:

1. A supervisor must know his men.
2. A supervisor must have confidence in his men.
3. The men must have confidence in the supervisor.

Know Your Men

A supervisor must know his men — their names, qualifications for trade ratings, educational (or self-taught) standards, whether they are married or single and their physical abilities to do their work. A supervisor must also be capable of recognizing limitations and potentialities, must know their personalities, their ambitions and interests on and off the job.

Once another chap and I (relatively new in the company) had just finished taking off an automatic control valve from a rather hot location and had cooled off in a smoking zone before reporting back to the steam plant. Just as we moved off into a no-smoking area, a loud voice halted "Smith" in his tracks. We both checked ourselves — there were no cigarettes in our teeth, nothing noticeably wrong. The command came, not from a foreman nor a superin-

tendent, but from the mill manager.

Automatically we surmised that something was out of order. But what came was, "Say, Jack, I noticed in the local paper that your mother was ill — not serious, I hope," and so on. Words like those from management summarize the principle.

Confidence in Men

Supervisor must have confidence in his men. If a man knows he is expected to perform a task of high standards, he will generally live up to that standard. Do not be afraid to let a man know you have confidence in his abilities. You have taught him his job. You have aided him in tasks that were not too clear to him. If his standards are not high enough, raise them, enlighten him.

It's no use doing the job yourself. I have seen foremen doing a task while a perfectly qualified man stood by just itching to get his hands on it. By doing this, you destroy a man's confidence and also tie yourself down to the impossible by assuming that you are able to supervise a number of jobs and also carry them out all by yourself.

I recently had this point forcibly driven home. I was learning to operate a pulverized-coal job and had heard of all the things that can happen in a "black-out." The advice and stories were all good but I'm from Missouri and have to be shown. During my first start-up, which went very well, I was told that "the baby was all mine and that I could operate O.K." My instructor would simply stand by. Everything went smoothly until the mill load fell to such an extent that I was forced to swing over to a single mill. During the changeover, the inevitable happened. I blacked the unit out by swinging the load too slowly. The steam flow dropped, the water level dropped, horns sounded and red lights blinked.

Through all this the operator stood grinning. "You see what a black-out is now, eh? — Go ahead and prove that you couldn't care less; I'll watch for trouble." To be honest, I felt like a seasoned operator by this time. I rectified the water level and lit-up again in a total of 4 min. If he had failed to show confidence and had jumped in, snarling "Let me do it!", I'm sure I would still be blacked out mentally.

Confidence in Supervisor

Last but not least, the men must have confidence in the supervisor. Does the potential supervisor know his job? Will he impart this knowledge on to his men? Will he put the welfare of his men over and above his own welfare? Will he expect his men to do things which he would not or could not do? A successful supervisor must be fair at all times. He must hand out the duties, the tasks and the "cream" fairly and unbiased. Give credit where it is deserved.

I have often heard an exceptionally good supervisor say to his men, "This is what I know about the situation (facts given). See if you can find out some more details." They go and are not afraid to explore and find the trouble. That same leader has shown confidence in his men and also that he will back them up by giving them responsibility.

Supervision lies not in the ability of a person to criticize, although constructive criticism certainly has its place. Never reprimand an employee in public, and if punishment must be meted out, then do so in a manner and only to a degree corresponding to the offense. Make the punishment and reason for it clear. Any veiling or covering of a punishment only defeats its purpose. A good supervisor must be able to recognize the difference between deliberate impudence, insubordination, a hoax, pure bad luck or misfortune, and deal with each case accordingly. A successful supervisor must have that "human touch." Without this he could quite easily be classified along with the punch-clock.

Station Operation During a Boom Period

By C. O. VON DANNENBERG

DETAILS GIVEN HERE concern a station built during a boom period where the ultimate load possibilities had to be guessed at and the availability of capacity to carry the probable load was of major importance.

Generating units were steam turbine driven, each with an output capacity of 15 mva with direct-connected 250-v exciters and without main generator field rheostats.

The transmission system into which these units fed included over 300 miles of 3-phase 66 kv circuit with few substations initially and these lightly loaded, so just how the system would perform was a matter of speculation since the generators were of standard design without regard to the system load characteristics. Actually when the system was first energized the exciter voltage dropped to less than 100 v and the voltage regulator action was most sluggish. This condition created instability from the slightest system disturbance and made it imperative to take immediate corrective measures.

Stabilization of the exciter required definite increase in its field strength, but with the limited funds available the corrective means had to be limited to the materials available. First consideration was given to raising the exciter voltage and improving its stability by inserting a fixed resistor in the main field circuit, but since this method indicated insufficient control range a variable field rheostat was considered. Either of the foregoing involved some expense and installation work. After a round table discussion with a diversity of opinions it was decided to apply separate excitation to the exciter field suitably reconnected, with the station control battery as a d-c source. Actually the current required was low in value and did not materially increase the fixed load drain from the battery. The required electrical connections were relatively simple and inexpensive to install and made possible exciter field stability for any condition of operation.

The conditions described were for generating units ordered over 25 years ago, and the corrective measures applied approximate present-day operation with high speed excitation systems. It is, of course, well known that for virtually zero per cent loading power factor conditions, units cannot be operated in parallel at more than 75 per cent of the rated capacity without special design. We have also in present-day systems the pilot exciter which provides current for the main exciter field only. We have also a development for pilot exciters, which results in simplified wiring and a more rugged unit by the elimination of a commutator through the installation of an a-c generator with permanent magnet revolving field and a selenium rectifier for supplying d-c to the main exciter field. Such an exciter was described in the June 1954 issue of POWER ENGINEERING.

"Since Chester set a new production record last month — he's had that holier-than-thou attitude!"

Fig. 1. Four two-stage rotary compressors installation at Pratt & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn. Left to right: drive turbines, reduction gears, first-stage compression cylinders and second-stage compression cylinders. The compressors supply a total capacity of 6600 cfm of air

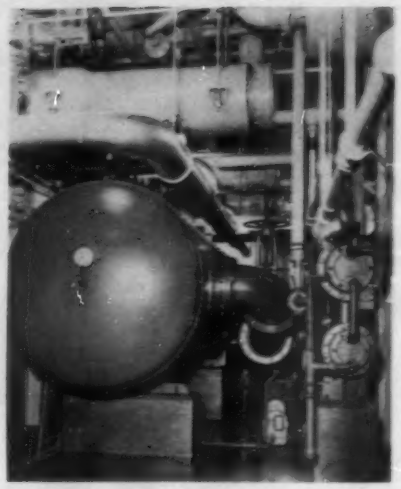


Fig. 2. Intercoolers (spring mounted from ceiling), two-stage aftercooler (right) and receiver (large drum) are located in space below the compressors

Rotaries Supply Compressed Air for P & W Expansion

Four new turbine-driven rotary air compressors go in small space; no heavy foundations, so auxiliaries are mounted underneath. Supply 6600 cfm of air for the Pratt & Whitney Aircraft Division.

By E. P. MEIXSELL *

EXPANDED production at the Pratt & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn., necessitated additional compressed air capacity for such general utility purposes as paint spraying, shot peening, sand blasting, operating machine tool chucks, cleaning, and the like.

To furnish the air needed, the company installed four two-stage, turbine-driven rotary compressors as shown in Fig. 1. Turbines and compressors are mounted in the power plant, within an 865 sq ft area. Two of the compressors (Fuller) are rated at 1500 cfm; two at 1800 cfm. The turbines (Elliott) are 375-hp machines. They are driven by steam at 200 psi; operate at 4550 rpm at top speed; and drive the compressors through 7-to-1 reduction gears. Variable capacity is obtained by operating the compressors through a speed range of 450 to 650 rpm.

Compressor rotor is supported on radial roller bearings. An automatic lubricator pumps oil in the correct amount to all bearings. Each lubricator is provided with safety devices to protect machines against lubricator pump drive-belt breakage or lack of oil in the reservoir.

Air enters through filters and is piped to the first-stage cylinders of the compressors where it is compressed to about 31 psi. It then flows through intercoolers that cool it from 230 F to about 90 F. It then enters the second-stage compressor cylinders, and is compressed to 110 psi. It then enters an aftercooler, which cools it from 290 F to 70 F. Following this, a separator removes condensate and oil, and the air then flows to a receiver and thence to the plant air distribution lines.

Dry-type intake filters (one for each compressor) are located in the room beneath the compressors, near the ceiling, to obtain as cool air as possible and to make use of basement space, at the same time providing ample room in the vicinity of the compressors. Filter cloths (felt) are blown clean weekly and are washed once a year.

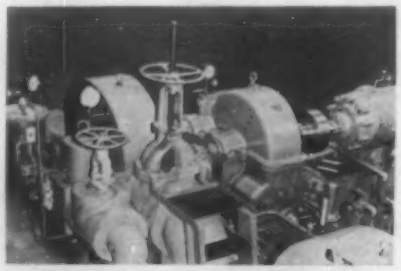


Fig. 3. Drive turbine and reduction gears. Throttle steam at 200 psi drives turbine at 4550 rpm; exhaust 25 psi

Each compressor is equipped with an intercooler, which cools the air between stages of compression. Intercoolers are suspended from the ceiling of the room below the compressors. Compressor cylinder cooling water and intercooler water flow in series, first to the high-pressure cylinder, then to the low-pressure cylinder, next to the intercooler and finally to boiler make-up.

Air from the second stages of all four compressors is discharged into a common manifold which delivers to a two-stage aftercooler, where air temperature is reduced about 220 F.

The two-stage aftercooler comprises two shell-and-tube heat exchangers arranged so that air from the compressors flows first to one shell and then to the other. However, each bundle of tubes receives its own individual supply of city water. Thus, when air which has been cooled in the first stage passes on to the second, it hits a bundle of tubes at the same temperature as the tubes in the first shell. This system permits more efficient use of water than a single-stage aftercooler and requires less floor space.

Exhaust water goes to boiler make-up. However, in the summer, exhaust water from both the aftercoolers and intercoolers goes to an evaporative condenser to replace water lost in condensing exhaust steam from various units of equipment.

An oil separator is an additional safeguard against oil or water getting to tools, damaging rubber parts, collecting in lines.

* Manager, Compressor Department, Fuller Co.

APC to Hold 17th Annual Meet

American Power Conference, Sherman Hotel, Chicago, March 30 to April 1, 1955 will discuss central station operating and research problems, industrial steam and power, electric system planning and operating problems, gas turbine plants, water technology, nuclear energy for power generation, fuel technology, research

BELOW is a digest of the program for the 17th Annual Meeting of the American Power Conference to be held March 30 to April 1 at the Sherman Hotel in Chicago. This program is designed to interest those engaged in almost every activity relating to the generation, transmission, or utilization of power.

The Conference is sponsored by the Illinois Institute of Technology in cooperation with 14 leading universities and ten National and Regional Societies throughout the United States.

For information write R. A. Budenholzer, Director, American Power Conference, Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

Conference will get under way with an opening meeting at 10 A.M., Wednesday, March 30, at which A. A. Potter, President, Bituminous Coal Research, Inc. will preside. John W. Evers of Commonwealth Edison Co. will show Where We Stand Today in the Electric Industry, and Howard P. Seelye of Detroit Edison Co. will discuss Research in the Utility Industry.

Central Station Problems

Steam Generators: — In one technical session, the Monotube or Once-Through Boiler for Standard or Supercritical Pressures, will be covered by Arthur T. Hunter of Combustion Engineering, Inc., while George P. Gamble and G. V. Williamson of Union Electric Co. of Missouri, will cover Operation of Large Central Station Steam Generators.

Research: — Research in the field of steam generators will be reviewed in two papers, one by Leslie S. Wilcoxson, The Babcock and Wilcox Company and one by W. H. Armacost of Combustion Engineering, Inc.

Second research session will cover Research in Steam Turbines, with papers as follows: Advances in Large Steam Turbine Research and Development by H. D. Emmert of Allis-Chalmers Manufacturing Co.; The Laboratory as an Engineering Tool in Steam Turbine Research and Development by F. K. Fischer of Westinghouse Electric Corp.; Research and Development in the Field of Turbine-Generator Prime Movers in the General Electric Co. by Glenn B. Warren of General Electric Co.

Power Plants: — Paul Gourdon of Ebasco Services, Inc. will give a paper on Central Station Design for Overall Economy. C. G. Merriman of Detroit Edison Co. will cover Dynamic Behavior of Power Plant Stacks Under Wind Loading, and W. S. Housel of the University of Michigan will discuss Soil Mechanics as Related to Power Plant Foundations and Construction. A panel discussion will be announced later.

Mobile Electric Automatic Generating Equipment for Utilities will be a paper by B. F. Hefner, K. O. Bower and E. A. Armstrong of Electro-Motive Division of General Motors Corp. Starting Requirements for Isolated Central Station Engine Driven Generators will be presented by A. Hoffman of Westinghouse, and Leo Brinson of Nordberg.

Cooling Towers: — Their Influence on Prospective Plant Sites will be covered by R. W. Gausmann of Indianapolis Power and Light Co., also in a paper Cooling Towers for the Power Industry by Frank J. Lockhart, Jack M. Whitesell and A. C. Catland of The Fluor Corp., Ltd.

Industrial Steam and Power

In one technical session, M. L. Jones of E. I. Du Pont de Nemours & Co., Inc. will discuss question When Should Industry Generate Electric Power? Let's Take the Guesswork Out of Industrial Power Costs will be presented by F. B. Banton, consulting engineer, and Fast Starting of 150,000 Lb-per-Hr Industrial Boilers will be described by C. E. Morrow and R. F. Born, Western Electric Co. Cole H. Morrow, J. I. Case Co., will discuss How to Reduce Spreader Stoker Fly Ash.

Industrial Power Applications: — Impact of Air Conditioning on the Electric Utility Industry will be brought out by Fischer Black of *Electrical World;* Principles of Automatic Controls will be covered by John Diebold of *Automatic Controls Magazine,* and Importance of Complete Coöperation of Heavy Equipment Manufacturers with Utilities by O. V. Talley of Allis-Chalmers Manufacturing Co.

Industrial Steam Generators: — In another technical session, the Air Preheater for Small Power Plants will be described by W. E. Hammond of Air Preheater Corp., while D. Cassino of Foster Wheeler Corp. will cover Standard Steam Generators — Influence of Design Changes on Cost.

Water Resources: — Session on this subject will include papers on the St. Lawrence Seaway by Raymond F. Speller of the St. Lawrence Seaway Development Corp.; on Utilization of Saline Waters by David Jenkins of Department of the Interior; on Rainfall Cycles and Water Supply by Royal W. Davenport of Department of the Interior; and on Use of Water for Irrigation, Navigation and Power by R. S. Pafford of the U. S. Division Engineers Office at Omaha.

Demineralizers: — Water Technology Session I will consist of a symposium on operation of demineralizers for treating makeup for steam power plants. J. A. Wallace and L. W. White of Iowa Electric Light and Power Co. will cover the subject as applied to Public Utility Plants; T. J. Judge and C. L. Davis, Jr. of International Paper Co. will discuss it as applied to Paper Mills, and Treatment With a Four-Bed Demineralizing Plant will be described by W. M. Mayer of Central Power and Light Co. Fourth paper will cover Treatment of Makeup Water with Automatic Mixed-Bed Demineralizer for Pennsylvania Electric Co. by J. H. Brendlen of Gilbert Associates, V. J. Calise of Graver Water Conditioning Co., and S. F. Borgel of Pennsylvania Electric Co.

Water Technology II will include a paper on Centralized Control of Boiler and Feedwater Chemical Treatment of the Valley Steam Plant by Russel C. Alexander and Jack Korenthal of the Department of Water and Power, Los Angeles, and a paper on Application and Treatment of Water for Heat Pump Systems by C. W. Millsom of Acme Industries.

In a third session, C. L. Mead of General Electric Co. will discuss Conditions Where Sticking of High Pressure Steam Valves May Occur, and Professor F. G. Straub of the University of Illinois will discuss Blue Blush Characteristics.

Final Water Technology session will include a paper on Filming Amines — Use and Misuse in Power Plant Water-Steam Cycles by J. F. Wilkes and W. L. Denman of Dearborn Chemical Co., and M. F. Obrecht of Michigan State College. J. G. Weidman of W. H. & L. D. Betz will discuss Experience with Filming Amines for Improving Heat Transfer.

Electrical Subjects

Electronics: — Session on this subject will include Closed-Circuit Television Systems and Their Applications In Industry by P. A. Lovelock of General Precision Laboratory; Multi-fuel Boiler Control by Paul Thanos of Inland Steel Co., and Fault Location with Radar Equipment by H. L. Garton of Commonwealth Edison Co.

Electric System Planning: — Overall Planning of Systems for the Long Range Future will be covered by H. L. Melvin of Ebasco Services, and Location of Future Generation — Economic Analysis by G. P. Wilson of Illinois Power Co. Industrial Power Distribution — Bus Duct or Load Centers will be discussed by Harry Decker of Electromotive Division, General Motors Corp.

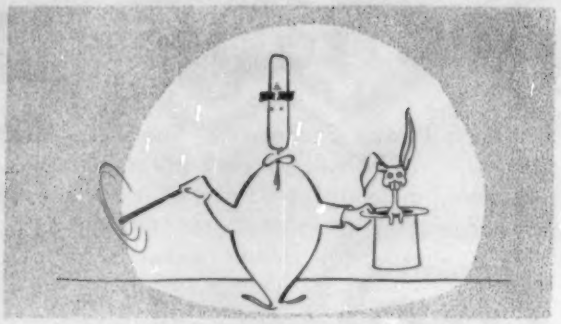
In the second session, Area Studies and the Prediction of Load Growth will be presented by E. L. Kanouse of the Department of Water and Power, Los Angeles, and Possibilities for Greater Regional Coordination of Power Systems in the United States will be discussed by Francis L. Adams of the Federal Power Commission.

Electrical Distribution: — Distribution Trends and Obsolesence will be presented by L. M. Olmsted of *Electrical World,* and the Voltage Divider Method of Capacitor Switching by Harold C. Stone of Line Materials Co. The session on Electrical Equipment will hear a paper on Use of Magnetic Amplifiers in Excitation Control by T. J. Bliss of Westinghouse; another on the Philosophy of Modern Generator Voltage Regulators by H. W. Gayek, A. S. Rubinsteim and M. Temoshok of General Electric Co., and on New Excitation System Without Commutators by W. L. Ringland and H. W. Cory of Allis-Chalmers Manufacturing Co.

Two papers will be given on Distribution Systems to Meet Rapidly Growing Residential Loads — one by H. H. Watson of General Electric, the other

continued on page 88

When various electrical and mechanical troubles occurred in these plants, located from the tropics to New England, the operators couldn't cure them. So they sent out hurry-up calls for the . . .



Power Plant Trouble Shooter

By A. P. BROADHEAD*

AT RISK OF arching the eyebrows of the "utterly moderne" engineer or technician or receiving the smile of approval from the "regulars," the author offers the following recapitulation of some cases of trouble — the odd cases, which have occurred and can recur on inside and outside electrical installations.

The Trouble Man is the fellow who gets called hither, thither and yon to solve as quickly as possible the mystery behind the various troubles which seem unsolvable to the man on the job, merely because the man on the job has allowed himself to become so "worked up" over the occasion that he cannot think clearly, or because his experience is limited.

Now let us take a trip or two with the Trouble Shooter and learn how he percolates — at least we can take the trip.

Tropical Trouble

Let's go South, away down south and under to a spot 12 degrees North of the Equator, a place known as "The Pearl of the Orient" — population about 600,000, Oriental yet Occidental, accustomed to typhoons and earthquakes — unique, cosmopolitan. Power supply 40 megawatts steam. A 20-megawatt hydroelectric plant ready to be tested for service, operating head 650 ft, all this was before the Japs messed it up. These plants were 90 miles apart and connected by a 3-phase 114-kv line.

Upon starting one of the 10 megawatt generators and applying excitation, the unit vibrated violently. After removing excitation the unit operated like a top. The reaction-type turbines were made and installed by one company, the generators by another company. The turbine erector claimed the vibration was due to the generator, while the generator erector claimed the opposite — the temperature in the plant, which was located at the bottom of a canyon, was 110 F — the humidity? too high; tempers? Hotter than —.

Disconnect the generator from the turbine and let's see who is correct about the vibration. The Trouble Shooter claims it was due to the turbine. Start the generator as a motor — generator up to synchronous speed — excitation applied — generator ran like a top, fed by the steam plant in Manila. . . . Cause of the vibration? The hydro turbine.

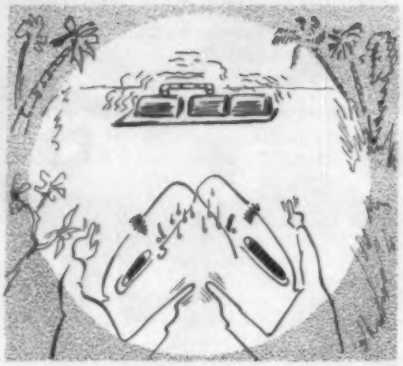


Fig. 1. Tropical trouble. Who caused the vibration. Turbine or generator?

Close examination revealed that the seal rings on the turbines were not true. Turbine erector, difficult to convince, reassembled unit — removed hand-hole cover on chamber "B" of turbine, started unit, applied excitation — no vibration; applied 12,500 kw load, still no vibration, convinced erector of turbine, removed seal rings on both 10 megawatt units, trued them in a ship yard plant, replaced rings, started both units, both O.K. Time required? Say, my friend did you ever work in the Tropics? Time required plenty. Final tests were made days and days and nights later — All O.K.

Before returning to the "States," there is some trouble to be cleared up at the steam station, trouble of long standing, so let's drop by and have a "look see." Records reveal that they have been replacing too many copper condenser tubes and the operating personnel were unable to state the cause. Close examination of the tubes revealed "pitting" or cavitation causing leaks. Cavitation caused by electrolysis, possibly galvanic action. Bearings of condenser pumps and other soft sleeve bearings were inspected and found to be attacked also. Substantial voltage readings were obtained on the joints of the steel work of the plant. Tests revealed the fact that the electric railway system return cable was faulty — in fact there appeared to be a direct return to the negative bus. It was discovered that the 2,000,000 C.M. cable from the railway 600-volt system was totally destroyed for a distance of about 1000 ft. This cable was buried or originally laid in ashes and cinders. Don't be afraid to test for electrolysis or for static in your plants; both can do a great deal of damage.

After a new return cable was installed in the proper manner, tests revealed a total clearing of the original trouble.

Humming Gas Meter

Phew! Let's go back to the States and cool off. Let's go down along the Hudson River, the Rip Van Winkle country, look into a case of trouble there. A sizeable town operating a gas and electric system, had an Edison 3-wire d-c system which had been operating for years. There was also

*Consulting Engineer

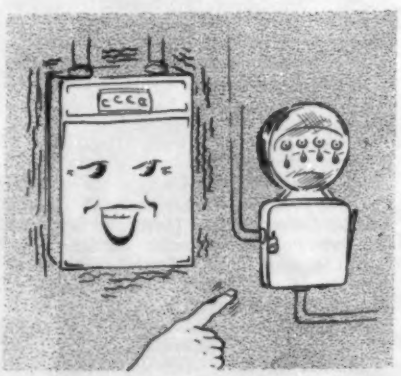


Fig. 2. Which made the loudest noise? The electric meter or the gas meter?

a 60-cycle system and a gas plant. A customer complained that his "lectric" meter hummed so loudly it could be heard all over the house. Investigation — main switch opened in cellar of house — hum continued — the gas meter close by was disconnected, that is an attempt to disconnect it was made, but an arc developed when the first coupling was loosened on the intake of the gas meter. A copper wire jumper was placed around gas meter — the meter was removed and the humming stopped. The jumper was removed and a fat d-c arc resulted — voltage readings across the intake pipe and the output pipe of the gas meter revealed 90 to 105 v. The d-c service to the house was underground, both gas and electric services were excavated and found parallel to each other, electric service was grounded — electrolysis had taken its score on both service mains and was the cause of the trouble. New gas service and a new 60-cycle service. The gas meter acted as a diaphragm or drum, causing the hum from the constant flow of electricity between the two services.

Mystery Breaker

So far the author has not given the Industrial Power Engineer or Electrician a break, so here 'tis. Let's run over to a New England town and visit a steel mill. The mill had been having trouble with either a 250 v d-c circuit breaker or a 250 v d-c motor. At the plant they were not sure which was at fault. So let's take a look-see.

The chief claimed the breaker opened quite regularly and often. True there is nothing strange about a circuit breaker opening in a steel mill, but let's tackle the job, and learn the cause of the opening breaker.

Let's check the meter readings on the particular panel of the switchboard. Amp readings range from 75 to 300 and 1,000, at 250 v d-c and fluctuating with the surges in load. Once or twice the ammeter went off scale and the d-c circuit breaker opened. This d-c was generated by an m-g set and each time the breaker in question opened the m-g set was found to have reversed polarity on the d-c end. All connections were checked and found to be O.K. The substation equipment was also found O.K. as well as the setting and operation of the circuit breaker.

All d-c motors on the circuit in the mill were found to be O.K. until we tried out a 75 hp compound wound motor, which drove a huge press for making pressed steel pulleys from cold flat plate. Readings were taken when the motor was driving the press idle — no trouble — the speed of the press was increased and load applied — reverse currents of 400 to 600 amp were obtained and the circuit breaker opened. The motor was not properly compounded and the inertia of the huge press upon release of the load drove the motor as a generator, bucking the m-g set in the substation. Since the motor was brand new, the company decided to return it to the manufacturer who promptly replaced the motor with a new one and everything was rosy from then on.

Thrust Trouble

The electrical mechanic of today has many facilities at his command which help him accomplish more in less time than was possible a few years back. For example, a case of motor trouble develops — customer hard pressed for the use of the motor — mechanic calls motor repair shop — borrows motor while the defective one is being repaired — all's well — — but now and then a baffling case of motor trouble develops as it did in a 75 hp, 440 v, 3-phase, 60-cycle, 3600 rpm motor.

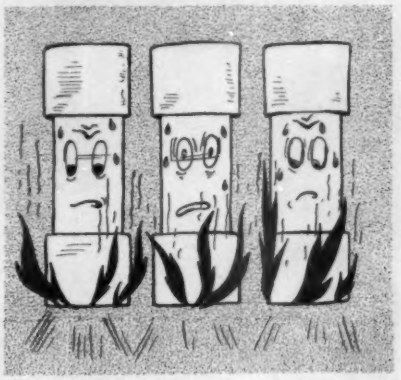


Fig. 3. Poor contacts can overheat a fuse just as surely as heavy currents

A motor of that size is not lying around motor repair shops waiting for someone to call for it. This motor is a squirrel cage induction — direct connected to its load. After 15 minutes operation on no load, the ball bearings heated, the rotor heated, and the stator heated a little. It was learned that this motor had just been returned from the motor repair shop. The driven machine bearings were cool and the machine mechanically balanced — mechanics checked bearing lubrication — disconnected the coupling to the driven machine — motor started, bearings heated — mechanic went so far as to replace the ball bearings — still heated as previously — mechanic checked voltage, air gap and was stymied — called in the Trouble Shooter, found end-thrust was off, too one sided or unbalanced, thus unbalancing the rotor, bearing surfaces, etc. Learned that the motor repair shop had installed a new shaft, for which rotor had to be rebored and the new shaft fitted — mechanics did not balance the rotor when they finished; the shaft was made by an outside machine shop. After balancing mechanically and magnetically all was O.K.

Down in the Catskill Mountains in New York state, a change in transformers was made in an outdoor substation, 3–300 kva, 33 kv–4.6 kv transformers — new from the factory, filled with oil, ready to install. They were properly installed and connected but when the station and transformers were energized nothing happened. The transformers were "dead." Fuzz stick tests showed 3-phase at the primary bushings but none at the secondary bushings. Removed the cover of one hand hole of one transformer, and found all leads to the terminal board merely cut off squarely and pushed into the terminal lugs — insulation not removed from ends of the leads and no attempt to solder had been made. The leads to the tap changer were the same on all the transformers. Such does not seem possible — but — it happened there.

Who'd Think of This?

An electrical contractor reported he was stymied when a large grocery chain store complained that their refrigerator motors tripped off on Sundays and early mornings and as a natural result the food was spoiled. The contractor had made the installation and had checked overload relays, temperature relays, fuses, thermal relays in motor starters, motors and wiring, and all was according to Specifications and Underwriters. Trouble Shooter was consulted — and told the contractor that his trouble was caused by high voltage.

It was like this: The service to the chain store was fed from an unregulated power circuit and during Sundays and other off-load periods ran as high as 30 per cent above normal. This overvoltage heated the holding coils in the motor line-starters and that extra heat, confined within the starter case, plus the motor load heat caused the thermal relays or cutouts to operate within the same starter cases. Contractor notified the power company who very speedily cut the service over onto a regulated circuit. Mission accomplished.

Hot Spots

It's the little things in life that count and give you headaches. Most folks look for big causes when things go wrong, but lots of real trouble can start in a small way. Here's a fellow who has a 10 hp, 3-phase, 220 v, 60-cycle motor, which began blowing fuses and finally could not be started — thought it was overloaded — found bearings and shaft worn. These two items were rectified and motor operated a few days then began blowing fuses again — winding was checked — apparently there was nothing wrong with the motor. Overload was again claimed, but tests proved differently. The Trouble Shooter, after listening to it all, advised checking for loose connections and high resistance spots in the circuit — found loose terminals on fuse blocks — fuse clips were blued from overheating as were the fuse ferrules and generally poor contact prevailed. The installation of new fuse and cutouts cleared up the affair.

New Compact TV Lets You Watch Anywhere in Your Plant

Permits remote observation, up to 1500 ft, of instrument readings or process operations anywhere. Another new device is Night-Viewer, converting infra-red radiation to visible image

TWO NEW devices have just been introduced by Curtiss-Wright Corp. One is a simple, compact, portable, high-fidelity closed-circuit industrial television system, Figs. 1 and 2. The other is the Night-Viewer, Fig. 3.

The basic closed-circuit television system includes a 6-lb camera, 8¼ in. by 6 in. by 3½ in., equipped with a small Resistron tube, a tripod, a remote control box, a control unit and one or more monitors. The equipment is easy to move, carry and set up. The picture is carried over coaxial cable to the monitors, which may be placed as much as 1500 ft away.

The Resistron tube is relatively insensitive to high temperatures. It is small enough so that standard lenses for 35 mm cameras can be used, instead of more costly TV sizes; it has great clarity of detail and drops off only from 5 to 8 per cent at the edges compared to losses up to 30 per cent at the edges for other types of tubes.

The tube is designed for long service life and can be produced for approximately 15 per cent of the cost of producing the type of picture tubes now used in studio television equipment.

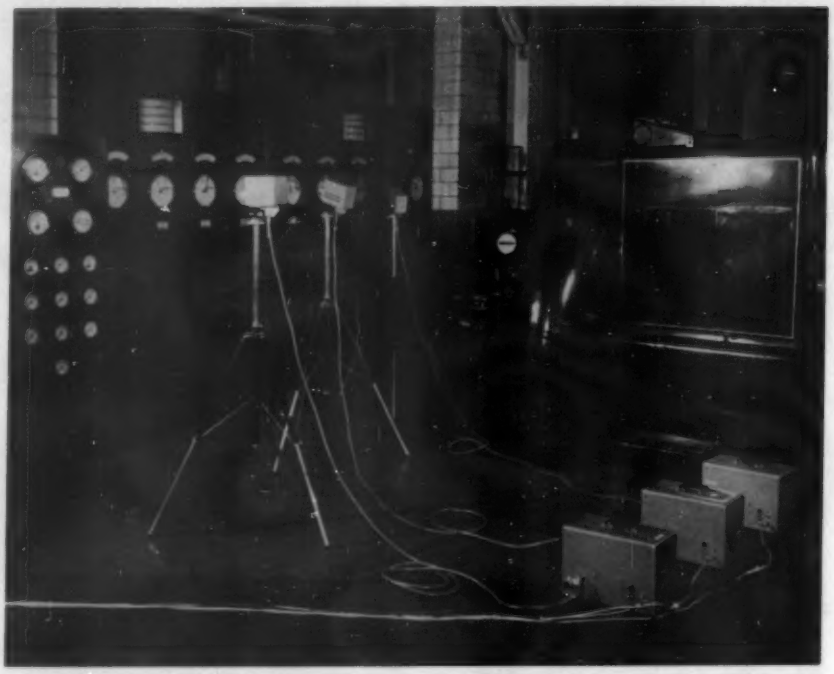


Fig. 1. Three industrial television cameras monitor boiler instrument readings in a brewery power house. Control unit on floor behind each camera. Picture in each camera, amplified and sent to remote monitors, for viewing as shown in Fig. 2

Fig. 2. On remote monitors, control operator observes instrument readings viewed by cameras of Fig. 1

For more data, write the Editor or write TV on post card elsewhere in issue

Fig. 3. Above: Plant security officer checks Night-Viewer that permits vision in complete darkness for more than 2 miles. Infra-red radiator projects invisible beam to selected object, receiver converts reflected infra-red rays to visible image. Equipment operates on power line or portable generator

cut along this line

LIQUID FILLED TRANSFORMERS

1. Liquid dielectric strength: Samples of insulating liquid taken from a transformer case should have a dielectric strength of 26 kv. If the liquid shows a dielectric strength of less than 22 kv, it should be reconditioned. Oil samples should be taken from the bottom of the tank while Askarel samples should be taken from the top.

2. Handling Askarel: Caution should be used when handling Askarel. It is a skin irritant. Unnecessary contact should be avoided, particularly when it is hot. Also, one dip with a perspiring hand is enough to ruin resistance of a tank of Askarel.

3. Don't mix oil and Askarel: Oil will mix readily with Askarel, and it is almost impossible to separate them. Avoid such contamination since it changes the non-inflammable characteristics of Askarel. For the same reason, a filter press used for Askarel should not be used to handle oil.

4. Storing insulating liquid: Containers of insulating liquids must be allowed to reach room temperature to prevent condensation of moisture during pouring.

5. Askarel dissolves varnish and paint: Never use Askarel liquid in a transformer designed for oil insulation since Askarel acts as a solvent on most varnishes and paints used in an oil transformer.

6. Keep tanks closed: Modern liquid filled power transformers are designed for very little transformer breathing during a normal load cycle and therefore the insulating liquid should not be exposed to moisture or oxygen in the air. A thorough inspection which would entail opening the tank for inspection of internal parts should be made only when there are definite indications of trouble.

DRY TYPE TRANSFORMERS

1. When to inspect: For dry and clean areas, inspection once a year may be sufficient. In contaminated atmospheres, maintenance may be needed every few months. After the first few inspections a definite schedule can be worked out.

2. Dirt: The transformer should be de-energized and the side panels removed for an inspection of insulating surfaces and airducts. Dirt in the airducts will reduce transformer cooling and will reduce its effective output considerably. Dirt may be removed from the windings with a vacuum cleaner, air blower, compressed air, or even nitrogen. Compressed air or nitrogen should be clean and dry and applied at a pressure not to exceed 25 psi. For large areas use a vacuum cleaner.

3. Drying out: If during a shut down condensation could occur within the transformer housing, strip heaters should be placed in the bottom of the unit to maintain a temperature inside the transformer case several degrees above outside ambient. When heating a transformer, it is recommended that the winding temperature not be permitted to exceed 100 C as measured by resistance or by thermometers placed in the ducts between the windings. When drying out a transformer resistance measurements should be taken at two hour intervals. As the transformer is heated, a rapid drop in resistance will probably occur, due to moisture, followed again by gradual increase till near the end of the drying period when it will increase quite rapidly. A curve should be plotted of time against resistance until the resistance remains constant for about 3–4 checks. The insulation resistance should be taken for each winding to ground with all windings grounded except the one being tested. Be sure to ground and short-circuit any winding to be measured to drain off possible static charge.

4. Insulation tests: An approximate value of 2 megohms per 1000 volts of name plate voltage rating is satisfactory but in no case should it be less than 2 megohms total. (One minute reading at approximately 25 C.) After a major overhaul or repair a high potential test may be applied. Test values for one minute are:

Insulation Class in Kv	Test Voltage in Kv
1.2	3
5.0	9
8.66	14
15.00	23

fold along this line — outside edges away from you

Power Engineering handbook

Anticipate and Schedule Upkeep of Distribution Apparatus

"PREVENTIVE MAINTENANCE is maintenance that is performed often enough to make repair work on the equipment unnecessary or not serious." This was the definition given by Philmore Belsky, switch-gear product engineer of the Westinghouse Electric Corporation, at a recent Los Angeles plant maintenance Conference. In his paper, Mr. Belsky listed the most important points to be observed in maintaining air-breaker metal clad switch gear, oil breaker metal plant switch gear, low voltage draw-out switch gear, ventilated dry type transformers, and liquid filled transformers. Below we have listed the most important items in these lists.

AIR BREAKER H-V SWITCHGEAR

1. When to maintain: For highly repetitive duty and heavy currents, inspection should be made at 2500 operations. When operating experience has been acquired, this figure can be modified to suit local conditions for each breaker. If the breakers are required to switch only normal load current and moderate overloads, a complete inspection and cleaning once a year may be adequate.

2. Burnt contacts: Considerable burning on the arcing contacts can be tolerated without detriment to breaker operation. However, when approximately one half of the arcing contact material is eroded, it should be replaced, for mechanical reasons. A moderate amount of burning or pitting on the main current carrying contacts does not matter because the normally high contact pressures will maintain good electrical conductivity. Rough spots should be dressed and contacts adjusted to maintain proper pressure and alignment.

3. Safety precautions: Safety precautions should be observed when inspecting a closed breaker. Should the breaker be tripped accidentally, severe personal injury can result.

4. Arc chutes: The insulating parts of the breaker arc chutes are subject to full line potential with the breaker contacts open. Therefore it is important that this insulation be given proper care. The chute should be blown out with dry compressed air through each of the slots between the arc splitter plates and over the lower shields at the end of the chute.

5. Ceramic material: Though repetitive arc interruption will dirty the ceramic material in the interrupter, it will probably still have a high dielectric strength. If in doubt, voltage tests can be applied for one minute at 60 cycles between arcing horns. Typical test values are 15 kv for 4.76 kv and 28 kv for 15 kv breakers.

Fig. 1. Inspecting contacts of a "de-ion" circuit breaker. Test jumper and control switch are provided here for operating breaker under test

6. Ceramic surfaces near contacts: The ceramic surfaces near the contacts should stand approximately 10 kv per inch with test prods applied directly to the surface of the chute. If parts are so dirty that they will not stand the insulation test, they should be taken apart and cleaned, using a sander if necessary.

7. Varnished organic insulation: Varnished surfaces must be kept smooth, glossy and free from foreign matter. They can be washed with cleaners such as Heptane, Triclene, Stoddard solvent or similar solutions that do not harm the varnish but quickly vaporize and leave no residue. After the solvent has dried, surfaces should be washed with distilled water and carefully dried. Handling insulation leaves traces of perspiration which eventually picks up additional moisture through condensation and causes excessive current leakage over the insulation surfaces. All varnished surfaces should be carefully cleaned when work is finished, before energizing the equipment. If, while cleaning, the insulation is seen to be thin or cracked, it should be replaced, using several new coats.

8. Level and adjustment of mechanical parts: The breaker and switchboard mechanical parts should be checked for adjustment and wear. Also level and alignment must be perfect. Many breakers operate badly for no other reason than lack of perfect alignment.

9. Lubrication: Lubrication can be used to relieve friction or binding but it should be remembered that oily surfaces accumulate dirt. So lubricate sparingly. Do not lubricate insulating surfaces or breaker contacts. Petrolatum jelly may be used on the breaker primary and secondary drawout connectors for ease of operation.

10. Voltage tests: The busses should be meggered between phases and to ground before and after cleaning and results should be recorded. Since temperature and humidity cause large variations in Megger readings, this is not an absolute indication of bus condition; however, records kept over a period of time establish a trend and give a good indication of progressive weakening of insulation. High potential tests are not necessary and are recommended

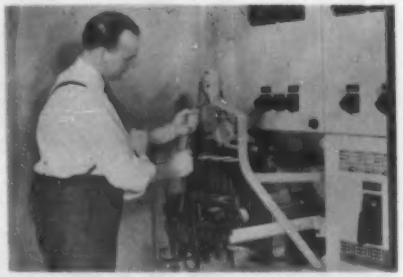


Fig. 2. Lifting rig for removing drawout type circuit breaker from its cubicle. Normal maintenance can be done with it still in the cubicle

Fig. 3. Removing arc chutes from air circuit breaker is usually easy with well-designed units

only after major overhauls or where Megger readings show an unsatisfactory trend. Such tests should not exceed 75 per cent of the factory tested values listed here for new switchgear in accordance with AIEE standard #27. Potential transformers should be disconnected during the test.

A. 4.76 kv-60 cycle test for one minute at 19 kv.

B. 15 kv-60 cycle, one minute at 36 kv.

LOW VOLTAGE DRAWOUT SWITCHGEAR

1. Lubrication: No part of a low voltage breaker should be lubricated except for a little petrolatum on the primary and secondary drawout connection for easing operations. The lubrication applied to the breaker parts during factory assembly is adequate for many years of service.

2. Oil dashpots: Series trip devices, if of oil dashpot type, should be removed at least once a year to see that they operate freely and that the oil is clean and of the type and viscosity recommended by the manufacturer. Air-displacement trips need little more than visual inspection and mechanical operation to make sure they are free to operate. If after cleaning and inspecting, operation is faulty, over current calibration checks should be made on trip element to insure proper timing operation of breaker on overload or short-circuit.

OIL BREAKER SWITCHGEAR

Many air breaker recommendations apply also to maintaining metal clad switchgear in the 4.76 and 15-kv class using lift type oil circuit breakers. The only real difference is in the oil break element which requires different maintenance procedures. This class of equipment has a test rack on which the removable breaker element can be elevated and the breaker tank lowered to expose contacts and interrupters.

1. Mechanical inspection: Each pole unit should be inspected to make sure operating levers are in good condition and that hydraulic dashpots are free from friction, that lift guides and rods are not cracked or warped and the contacts are properly secured and make good contact. The interrupter grids should be checked for alignment, warpage and tightness. Any traces of carbon should be removed from the grid stack.

2. Oil checking: The condition of the circuit breaker oil is of major importance in successful breaker operations. Presence of carbon on insulating surfaces will reduce insulation strength, and when this happens the oil should be reconditioned even though satisfactory dielectric tests are obtained. The oil must be kept clean and dry not only when filling the tanks but whenever the tanks are opened for inspection. When the oil dielectric strength drops below 22 kv from a normal of about 26 kv, it should be purified.

Fig. 4. Dirt and oil round transformer cooling tubes results in less cooling and a reduced output

3. Cycle timing: Timing tests are not usually necessary unless adjustments are made or new parts installed, but, where it is needed, the speed of opening or closing can be checked with a cycle timer, Cincinnati timer or oscillograph, to be certain the breaker is operating in the same condition as when first installed. A minimum closing or trip coil voltage can be used as a check against original factory values to give a good idea of mechanism adjustment.

Fig. 13. Always be sure feet are on a firm and level base

Fig. 14. Look out for traps. Make sure ladder is in safe position

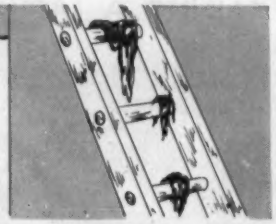


Fig. 15. Keep oil and grease off rungs to prevent slipping

Fig. 16. Always keep hands clear when climbing up or down ladder. Use rope sling to haul tools

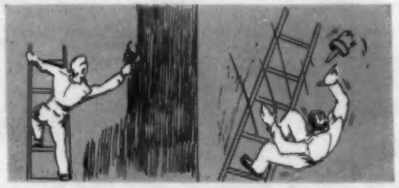
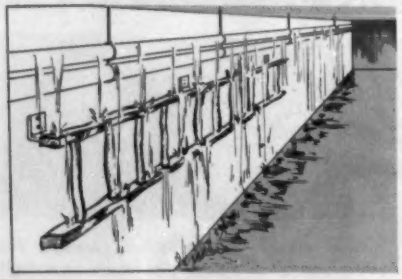
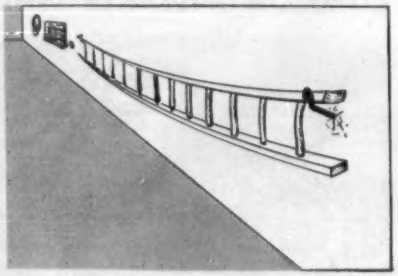
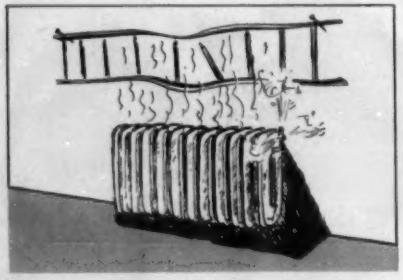


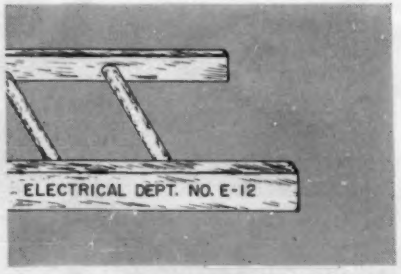
Fig. 17. Don't reach sideways. Take the trouble to climb down and move ladder to new position

STORAGE . . . Good & Bad Practice









Power Engineering handbook

How To Outlast Your Ladder

READ PRACTICALLY any article on ladders and you'll find, tucked away among the warnings, the statement that familiarity breeds contempt. The implication is that people hurt themselves with ladders because they are too familiar to treat them carefully. But this view is incorrect. People have accidents with ladders because they are ignorant.

To use a ladder properly, you have to apply many principles of mechanics. Many people who use ladders are unfamiliar with these principles, and their mistake comes from thinking they know how to use a ladder without understanding these principles. They put ladders at wrong angles and slip because they are ignorant of the elementary principles of friction. They use makeshift ladders that break because they are ignorant of the strength of materials. They kill themselves with extension ladders because they are ignorant of bending moments. They fall sideways off ladders because they are ignorant of the principles of static equilibrium. They ruin ladders by bad storage because they are ignorant of the effects of heat and moisture on organic materials. Even when they know all these principles they still have accidents because they are too careless to apply them.

For the illustrations in this article we are indebted to the American Ladder Institute, The National Safety Council, and Paul C. Ziemke, Oak Ridge.

MAKESHIFT LADDERS

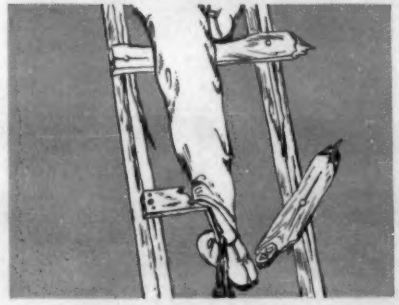


Fig. 1. Never use makeshift ladder. They cause more accidents than all other causes together

TESTING

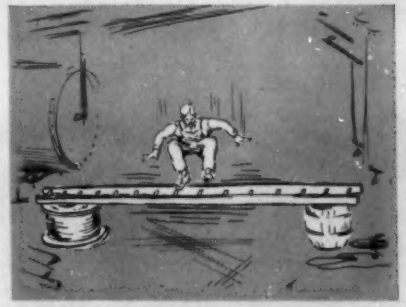


Fig. 2. Don't test ladders. A test usually does more harm than good by causing strains in the ladder

cut along this line

fold along this line — outside edges toward you

WRONG WAY TO CLIMB DOWN

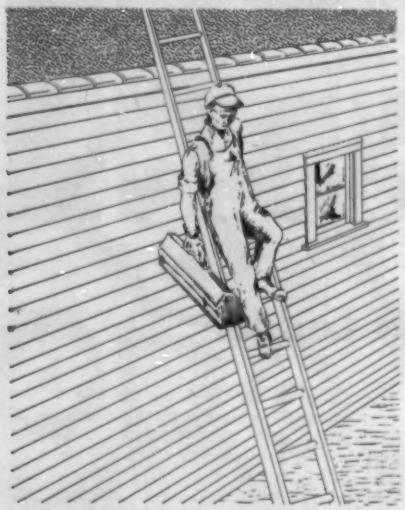


Fig. 3. The wrong way to climb up and down. Man should face ladder and should not carry anything

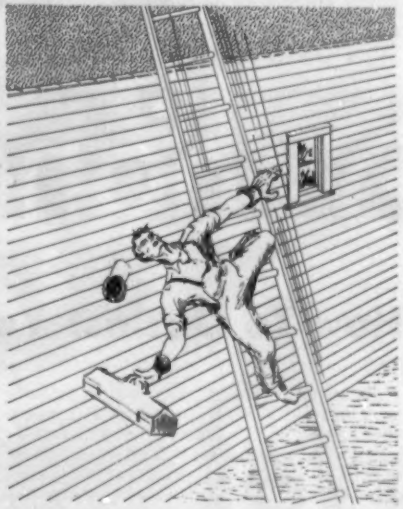


Fig. 4. Result of method shown in Fig. 3. Easy to slip and you've no control once you start to fall

EXTENSION LADDERS

Fig. 5. Make sure you have enough overlap. Up to 36 ft ladder length overlap should be 3 ft; from 36 to 48 ft, 4 ft; and from 48 to 60 ft, 5 ft overlap

RIGHT SLOPE

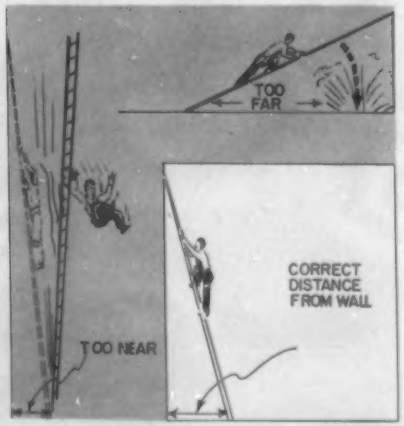


Fig. 6. Right and wrong ways to set ladder. For correct slope horizontal distance from wall is ¼ vertical distance from support point to ground

RAISING A LADDER

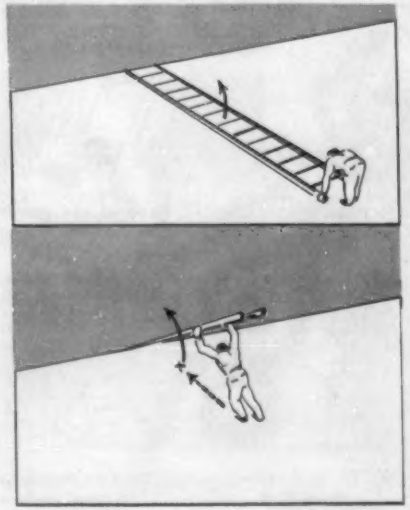


Fig. 7. Place ladder feet against firm support and raise ladder by walking towards the feet

TYING TOP END

Fig. 8. Wherever possible, top rung of ladder should be tied to support to prevent its slipping

COMMON MISTAKES WHILE USING LADDERS

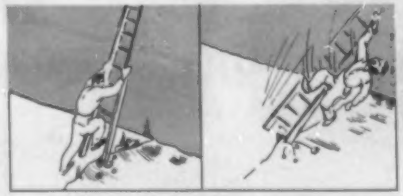


Fig. 9. Make sure both feet of ladder are on firm ground. If one foot sinks ladder will topple

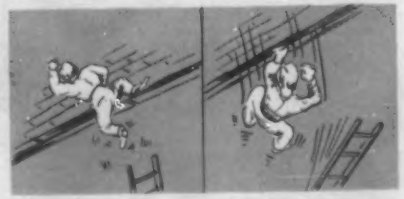


Fig. 10. Be sure ladder is long enough. You shouldn't have to do acrobatics to get on and off

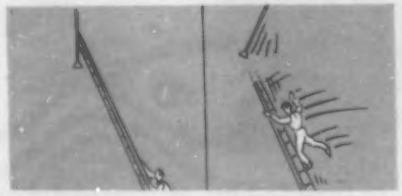


Fig. 11. Don't use ladder where it can't be used safely. Use another method or move equipment

Fig. 12. Be wary of non-slip feet. On waxed floor they can pick up wax and become very slippery

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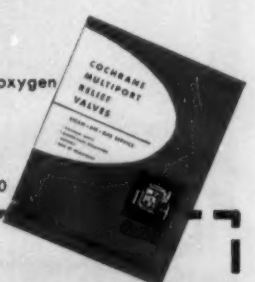

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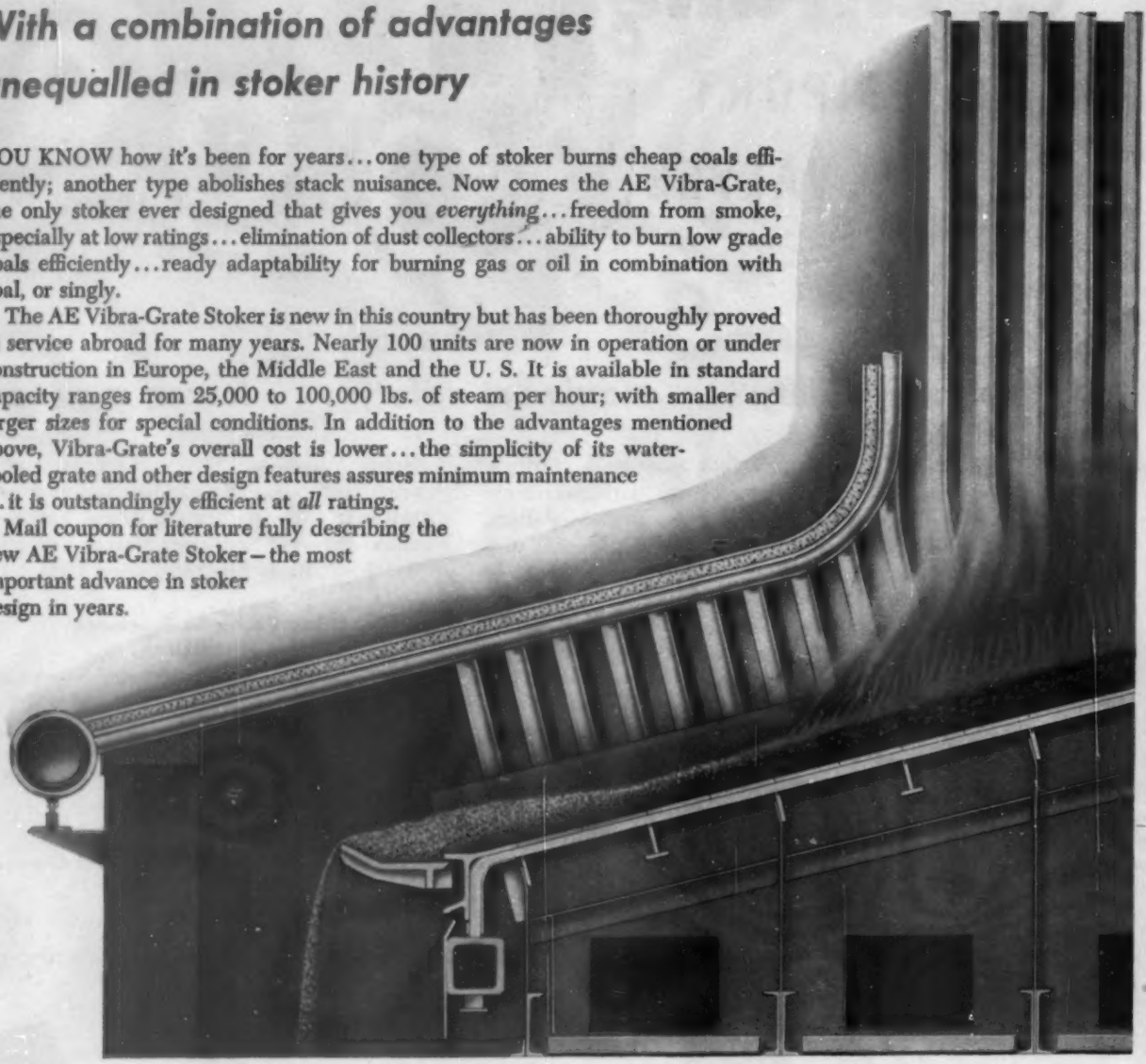
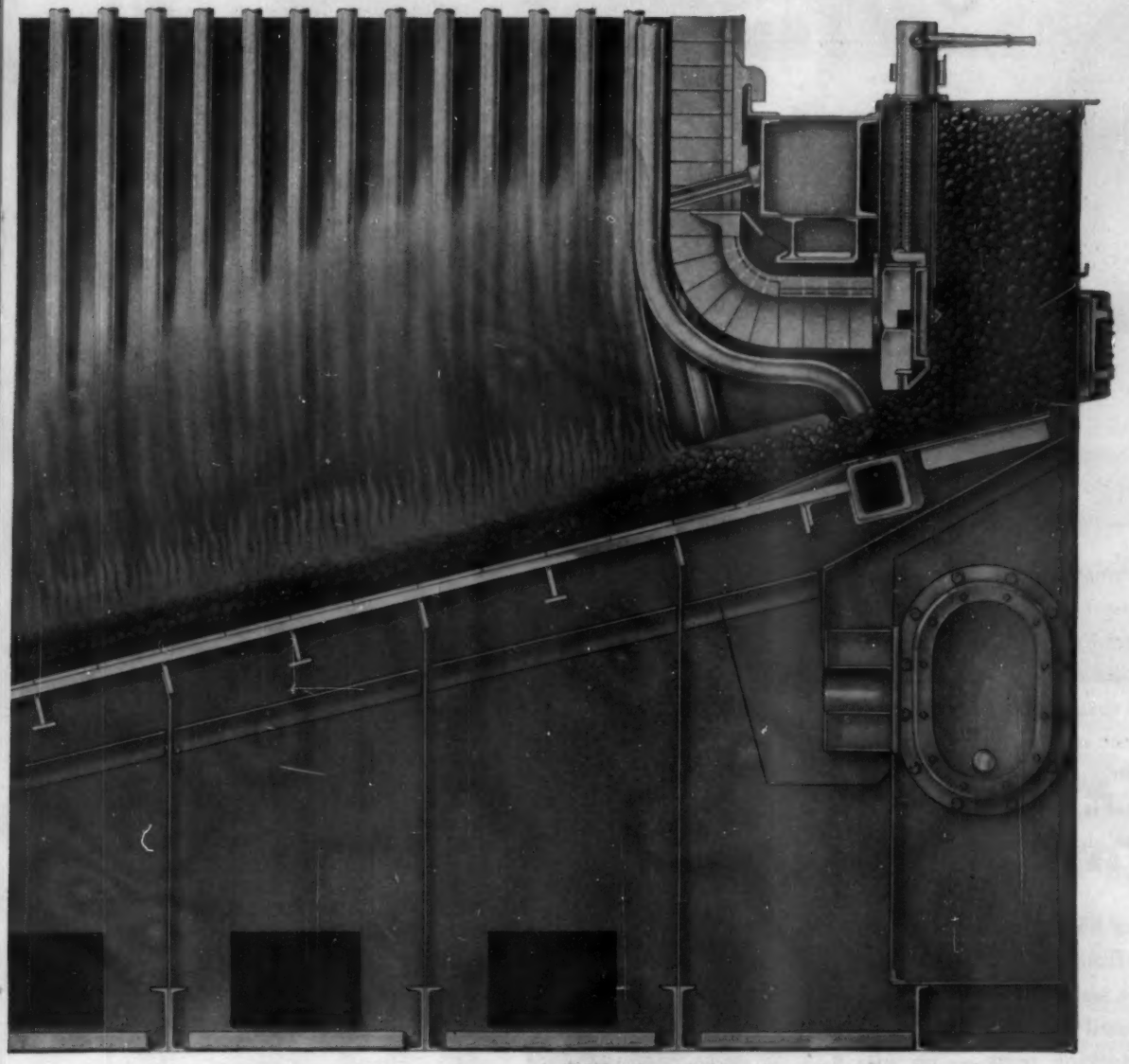


WATER TUBE SECTION –
showing mounting of grate blocks.

VIBRA-GRATE STOKER

(COMPLETELY WATER-COOLED)



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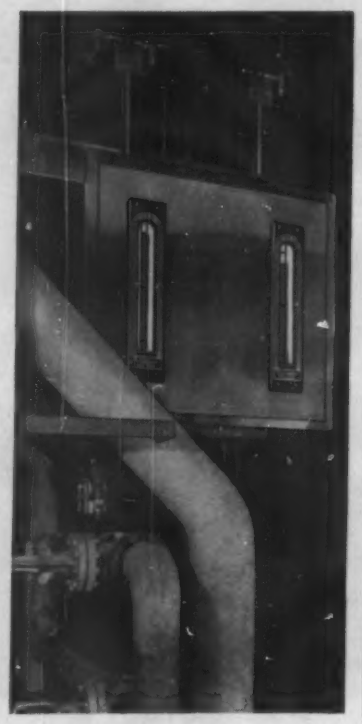
You can place EYE-HYE any reasonable distance from the drum — above or below it, on wall or instrument panel. Easy to install and maintain — no mechanical working parts — no adjustments on location. Write for Bulletin CO and learn how EYE-HYE can increase the efficiency of *all* your water levels.



How one user checks water levels in surge tank and feed water heater with long type EYE-HYEs. (Face plate can be calibrated at factory.)

The Reliance Gauge Column Company
5902 Carnegie Avenue • Cleveland 3, Ohio

Condensate Control

continued from page 55

used whereby control air loading from a single level-control device is used to pilot both the throttling valve and recirculation valve (see Fig. 5). A reverse acting air relay is used at the recirculation valve to permit the use of a valve which will fail safe (open on air failure). As the hotwell level tends to drop, the level controller output air pressure increases, thereby reducing the throttling valve opening. When a predetermined control air pressure is reached, the recirculation valve begins to open. Further tendency for decrease in hotwell level results in greater control air pressures and further closing of throttling valve and opening of recirculation valve. As might be expected, all this in one control arrangement is a little tricky to set initially and to keep in adjustment.

A variation of throttling control has been used successfully in a number of large recent installations. In these systems the deaerating heater has been eliminated from the feedwater cycle leaving all deaeration to take place in the condenser. With the open deaerating heater eliminated, the condensate pump delivers water through the low pressure closed heaters directly to the boiler feed pump suction as shown in Fig. 6. The feed pump is throttled by the boiler water regulator which results in throttling of the condensate pump. Protection is afforded inter- and after-condensers and turbine coolers at light loads by manually controlling recirculation from feed pump discharge back to the condenser. Constant hotwell level is maintained by automatic transfer of condensate between the hotwell and a large condensate storage tank.

It is concluded that throttling type condensate pump control is the most satisfactory primary method of control for use with the many conventional steam power plant arrangements. Either manual or automatic low load recirculation may be incorporated with automatic throttling.

Chalmette Plant

continued from page 62

good characteristics to justify its continued use.

The nature of the electrolytic reduction operation dictates that generally the power demand upon the gas engines is relatively very constant; however, disturbances usually involve a complete and instantaneous loss of the entire 50,000 kw "potline" load. The engines are individually governed for constant speed and limited by an individual load limit de-

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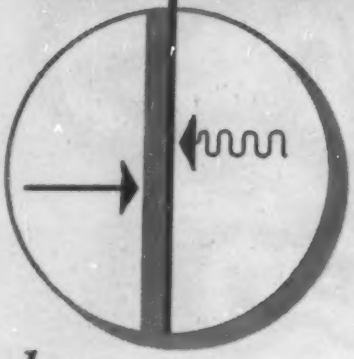

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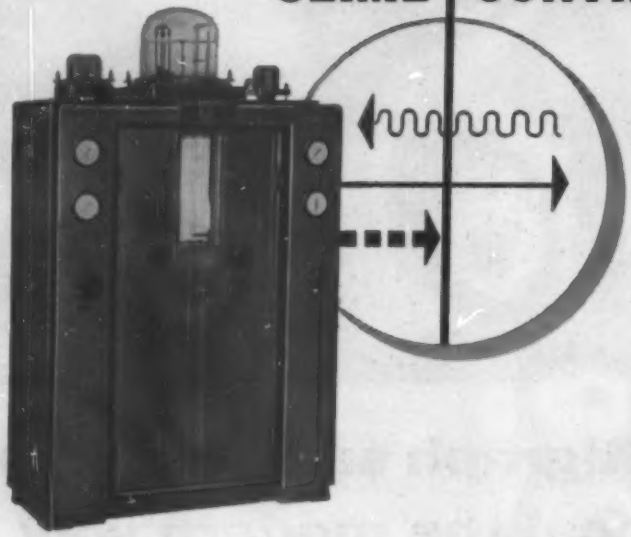

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Chalmette Plant

continued from page 86

vice that controls the maximum opening of the gas fuel control valve.

The generators are shunt-wound type and, because of the almost ideal capacity of 1290 kw, made an excellent counterpart for the gas engine, thus providing an economically sound power producing unit.

After much experimentation, brush life has been standardized at about 8000 hr per inch. Burnishing of the commutator has been best accomplished with use of a Morganite EG-14 brush under about 4-lb spring tension. The brush rigging consists of 56 brushes per generator.

Chemical treatment of the individual closed jacket water systems of the engines has been satisfactorily accomplished by maintaining a potassium chromate and phosphate residual in these systems that are filled with domestic water supplied from the Domestic Water Plant.

Organizationally, the Gas Engine Plant is considered as a section of the total power generating and distributing organization, and no supervision is specifically assigned to this facility; supervision is assigned to either the total generating facilities or the total power distributing network. Specific gas engine operators and a Results Engineer are, however, assigned to the gas engine plant.

Of the 40 engines in each engine room, 37 are normally fully loaded, and 3 are either on standby or undergoing maintenance or routine inspection. Such operating condition promote efficient operation but demand a high degree of availability of equipment.

APC Annual Meet

continued from page 75

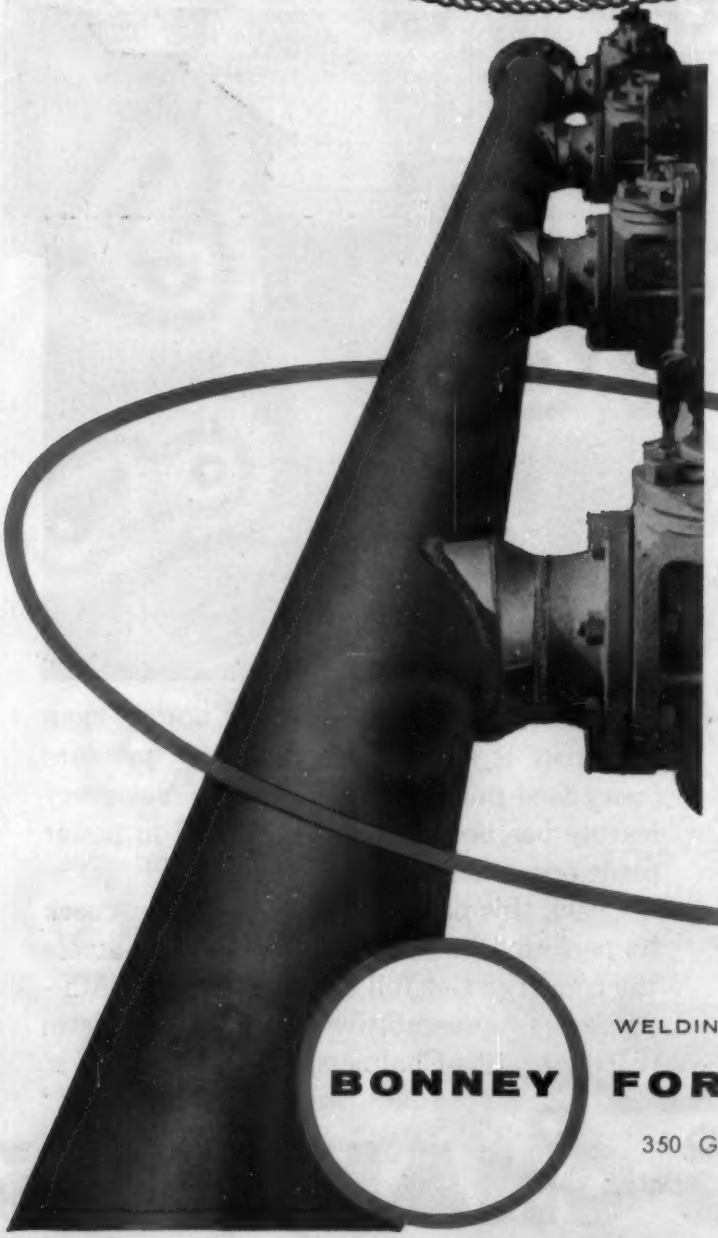
by H. E. Lokay of Westinghouse Electric Corporation.

In a session on industrial work, T. H. McGreer, Sargent & Lundy, will discuss Series Capacitors Eliminate Voltage Fluctuations in Industrial Plants. W. M. Terry, Allis-Chalmers will present Dry Type Versus Liquid Cooled Transformers for Industrial Systems. There will also be a session including four papers on Computers and Network Analyzers.

Nuclear Energy

General interest panel session on this subject will include as panel members Philip Sporn, president of American Gas & Electric Co., and Walker L. Cisler, president, Detroit Edison Co., and others to be announced.

In another nuclear session, Reactor Research and Development will be covered by W. Kenneth Davis of the Atomic Energy Commission. Sodium Reactor Power Plant will be described by Chauncy Starr, North American Aviation, and Technology and Basic Economics of Nuclear Fuels will be



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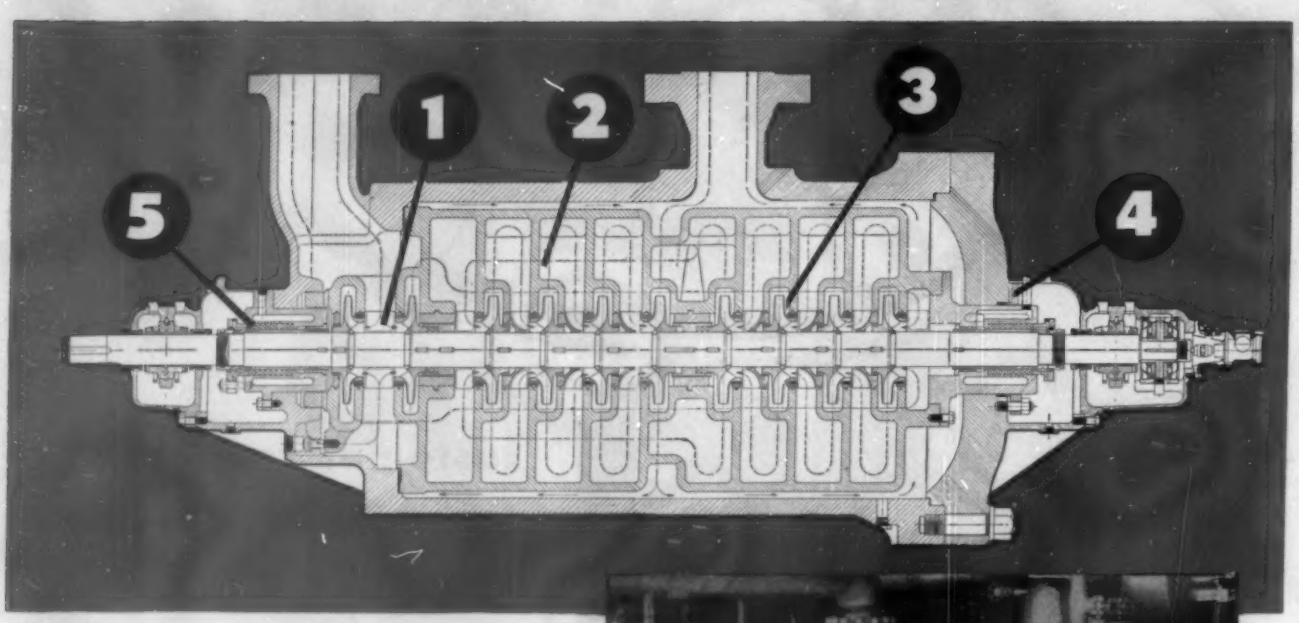

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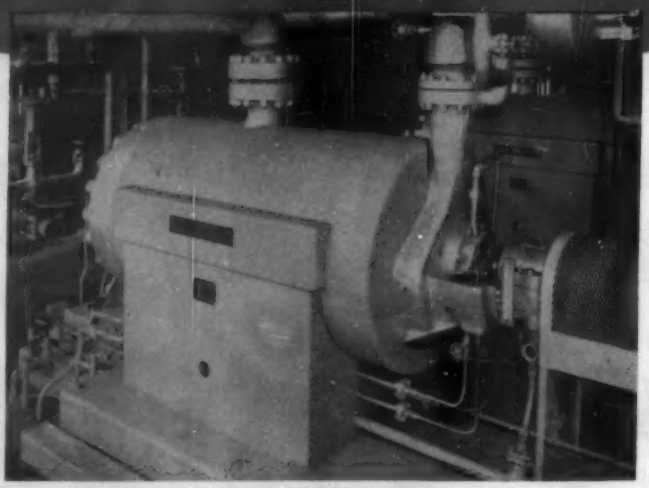
5 Five Sealing Options — Gland seals may be standard packing, packingless, bleed-off, condensate bleed-in, or mechanical seal, depending on your exact requirements.



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APC Annual Meet

continued from page 88

covered by Walter Zinn of Argonne National Laboratory. C. H. Gay of the Babcock and Wilcox Co. will discuss Power From Atomic Energy.

Gas Turbines

Small Units: — This session will include Components of Automotive Gas Turbines by W. W. Chao of Ford Motor Co., and Automotive Gas Turbines by W. A. Turunen of General Motors.

Power Plants: — This four-paper session will include Combined Gas Turbine Steam Turbine Power Plant Cycles by A. A. Hafer and W. B. Wilson of General Electric; also one on a 15,000-kw Gas Turbine Power Plant by T. J. Putz of Westinghouse; and one on Application of Gas Turbines to Nuclear Power Plants by Howard Grantz of General Electric.

Fuels

In this session, Ford K. Edwards of National Coal Association, will talk on Probable Trend in Coal Freight Rates. Research in Natural Gas Substitutes will be covered by E. S. Pettyjohn of Institute of Gas Technology; Research in the Coal Industry by H. J. Rose of Bituminous Coal Research, Inc., and Research in the Petroleum Industry by J. K. Roberts of Standard Oil Co. of Indiana.

Usual Power Conference luncheons and the Annual Banquet will be held. At the Wednesday luncheon, Harold Quinton, President of Edison Electric Institute and also of Southern California Edison Company, will be the speaker. Speaker on Thursday will be C. H. Linder, Vice President of General Electric Co. Speaker for All Engineers' Dinner, Thursday night, not yet announced. At Friday Conference luncheon, Farrington Daniels of the University of Wisconsin, will speak on Solar Energy.

OBITUARIES

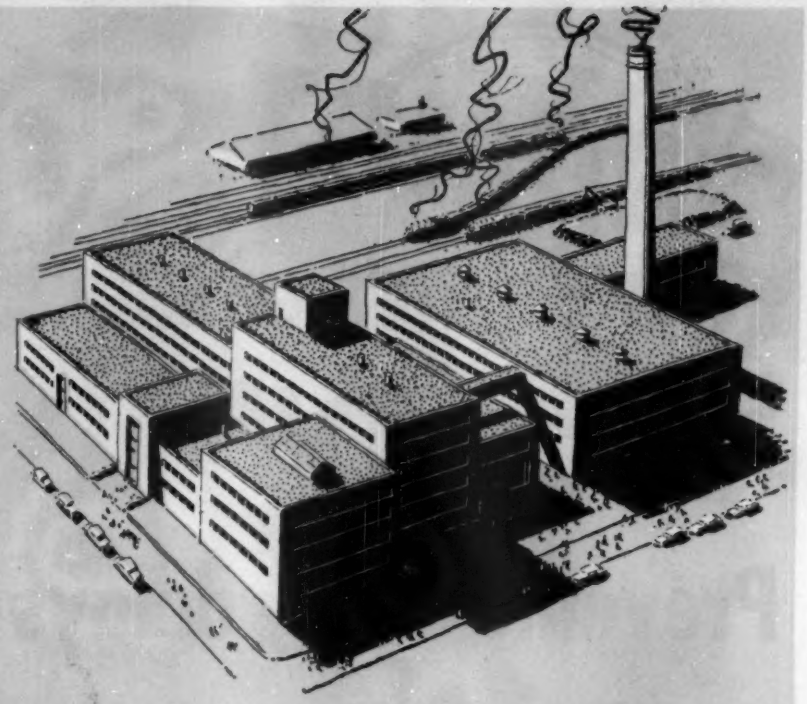
Paul L. Bartow

PAUL L. BARTOW, 52, chief mechanical engineer of the Florida Power Corp., died January 14, in St. Petersburg. Mr. Bartow was a veteran employee with 30 years service in the company and for the past 10 years was in charge of all the power plant expansion of the company.

He was a member of ASME and a long-time member of the Prime Movers Committee of the Edison Electric Institute. He was graduated in mechanical engineering from Georgia Institute of Technology and was well known throughout the utility industry.

Max Jakob

MAX JAKOB, widely-known authority on heat transfer, died January 4, 1955, at his home in Chicago, Ill. He was 75 years old. Dr. Jakob was a



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Obituaries

continued from page 91

research professor in mechanical engineering at Illinois Institute of Technology and director of its heat transfer laboratory.

Max Jakob

He came to the United States in 1936 from Germany, and joined the staff of IIT in 1937, developing its heat transfer laboratory into a center of graduate research that has drawn scientific investigators from all parts of the world.

He was author of about 150 articles in the fields of electro-physics, heat transfer, thermodynamics and allied subjects, and author of a number of books on heat transfer. He was a member of ASME, AICE, ASEE and Sigma XI. The honorary degree of Doctor of Engineering was conferred on him in 1950 by Purdue University, and he was awarded the Worcester Reed Warner medal by ASME in 1952.

NEW ENGINEERING BOOKS

Tentative Specifications for Copper and Copper-Alloy Welding Electrodes (ASTM Designation B 225) and AWS Designation A 5.6); also Tentative Specifications for Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Rods and Bare Electrodes (ASTM Designation A 371) and AWS Designation A 5.9) were issued jointly in 1953 by the American Society For Testing Materials, 1916 Race St., Philadelphia 3, Pa., and the American Welding Society, 33 W. 39th St., New York 18, N. Y. Copies can be obtained at 25 cents each by writing to either organization.

★ ★ ★

1953 Supplements to the Book of ASTM Standards, available in their latest form, give 325 specifications, tests and definitions which were either issued for the first time in 1953 or revised since their appearance in the 1952 Book. Pertinent supplements are: Part 1. Ferrous Metals, 380 pages; Part 2.

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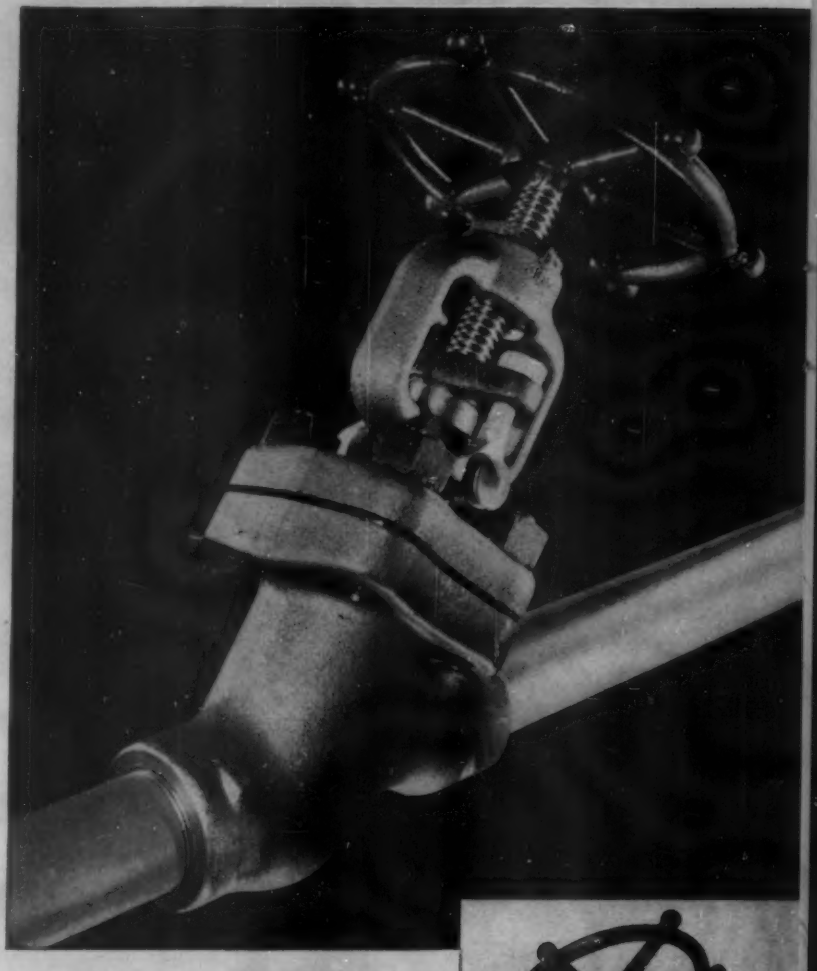

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Engineering Books

continued from page 92

Non-Ferrous Metals, 288 pages; Part 3. Cement, Concrete, Ceramics, Thermal Insulation, Road Materials, Waterproofing, Soils, 400 pages; Part 5. Fuels, Petroleum, Aromatic Hydrocarbons, Engine Antifreezes. Price of these Supplements, in heavy paper cover, is $3.50 per part. They can be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

★ ★ ★

ASME Boiler and Pressure Vessel Code: Suggested Rules for Care of Power Boilers, Section VII,/1954 Edition. Size 8½ in. by 11 in.; 52 pages. Published by The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

This is the latest edition of Section VII of the ASME Boiler and Pressure Vessel Code. This section covers Suggested Rules for Care of Power Boilers, and is divided into the following subsections: C1, Rules for Routine Operation; C2, Operating and Maintaining Boiler Appliances; C3, Rules for inspection; C4, Rules for the Prevention of Direct Causes of Boiler Failures; C5, Partial Rules for Installation; C6, Rules for Operating and Maintaining Power Boiler Auxiliaries, and C7, Control of Chemical Conditions.

★ ★ ★

Electric Power Transmission, by John Zaborszky and Joseph W. Rittenhouse; First Edition 1954; 676 pages, 6½ by 9¼ in., cloth; published by The Ronald Press Company, 15 East 26th St., New York 10, N. Y. Price $12.50.

Material included in this book offers a complete and balanced treatise on the steady state operation of transmission lines and power systems, as well as on the methods available for the study of such operation. It presents the subject in terms of today's requirements, achievements and opportunities. It provides broad coverage of the subject and treats, in detail, the fundamentals of transmission. The book should be equally useful as a text for undergraduate or graduate courses in Power Transmission, as well as reference work for the practicing engineer.

The practical usefulness of the work is enhanced throughout by discussions on the many recent technological advances, providing easier and more complete analysis of power system performance. Included are such topics as the universal circle diagram, new methods for calculating power system losses and for the inclusion of such losses in the study of the economy of system operation; the use of probability methods to establish generator reserves and a method of calculating skin and spiraling effects in stranded conductors.

Important topics often neglected in books on power transmission are also covered. The only existing significant reference information on voltage and low frequency regulation

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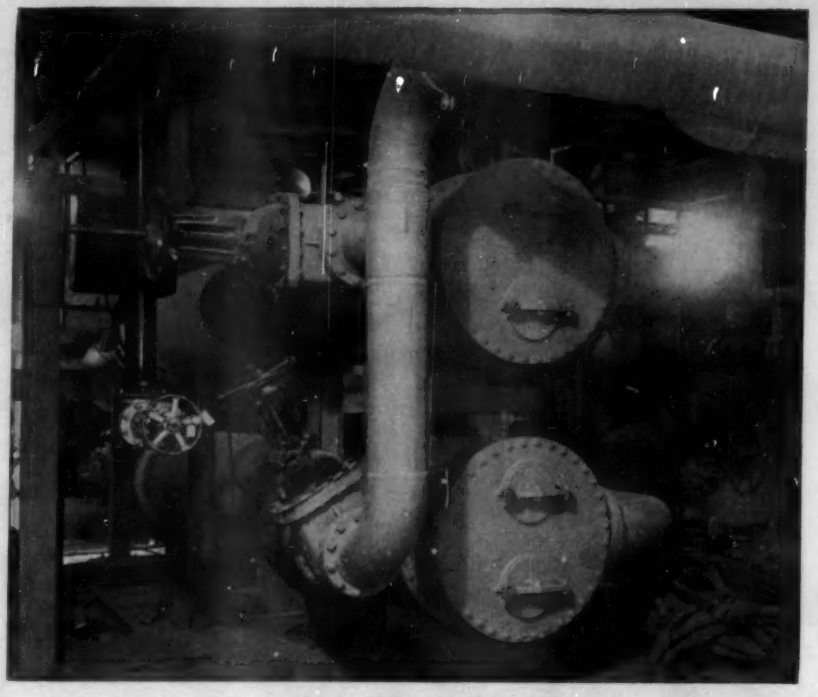

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Engineering Books

continued from page 95

has been in isolated and uncoordinated engineering papers. Since these areas represent large and increasingly vital fields in power system operation, this material has been brought within the scope of this work.

As to the authors — John Saborszky is Professor of Electrical Engineering and Joseph W. Rittenhouse is Associate Professor of Electrical Engineering — both at the University of Missouri, School of Mines and Metallurgy.

★ ★ ★

A Treatise on Electricity and Magnetism by James Clerk Maxwell. An unabridged Republication of the last, Third Revised Edition Volumes I and II bound as one. Size 5½ by 8½ in.; 500 pages, clothbound. Published by Dover Publications, Inc., 1780 Broadway, New York 19, N. Y. Price $4.95.

Many authorities consider James Clerk Maxwell the greatest theoretical physicist of the nineteenth century. The rapid advance in our knowledge of electricity over the past 75 years owes much to the classic work of Maxwell. Not only did he lay sure foundations for the subjects of electricity and magnetism, but time and again throughout his work in theoretical and experimental physics he indicated the paths to be followed by his successors in the twentieth century.

This edition contains all of Maxwell's published papers, lectures, addresses, essays, and short treatises.

We should warn readers who may be misled by the title that this is far from being an elementary textbook. Most of the subject matter is abstruse, and though Maxwell's theories have been confirmed time and again by subsequent experience, the writings in the book are still theoretical discussions developed in the nineteenth century.

★ ★ ★

Statistical bulletin for the year 1953, number 21, publication number 54-2, Edison Electric Institute. 64 pages, 8½ x 11 in.; paper binding. For sale by the Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y. 1954. Price $1.00.

If you have had the preceding issues of this bulletin, then you know what it contains. It is merely brought up to date for the year 1953.

If you have not seen the Edison Electric Statistical Bulletin for preceding years, this is as good a time to start as any. It presents a very comprehensive picture of your industry, statistically speaking. A listing of the section heads should indicate the nature of material contained herein; capacity and peaks, generation, energy sales, customers at year end, revenues, operating data and ratios, financial. Each of these catagories is dealt with in some detail which allows the power industry to take a close look at where it has been and make some rather shrewd guesses about where it is going. As usual, it does its job very well.

Handles Hot Loads At Cool Savings

Hundreds of installations—in different industries, under various conditions, in every section of the country—have proved beyond question that Kaloric-Type 890 is the best heat-resistant conveyor belt on the market. It is specially engineered to handle hot materials—*very* hot materials, even up to 350°. Under favorable conditions it will withstand much *higher temperatures!*

Among the hot substances successfully conveyed by this unusual belt are: coke, limestone, cement, fertilizer, sintering, ores, slag, fuller's earth, char, foundry shakeout sand, sugar crystals, soda ash, chemically processed oxide, refractory mix, glass, asphalt and talc.

All Kaloric-Type 890 belts are made with a special Neoprene compound that gives the best heat resistance. They are available in three carcass constructions: for temperatures up to 250°F., multiple plies of cotton duck; for temperatures above 250°F., plies of a special cotton and glass fiber duck. These are woven with cotton in one direction and fiber glass in the other, and each ply reversed in direction of glass and cotton. Skim coats are applied between plies for insulation and extra flex-life. Extra heavy top covers of special heat resisting compound (¼" to 5/16" are not unusual) resist temperatures that would cause ordinary belt covers to harden and crack.

Kaloric-Type 890 belts are available in widths up to 72", any length, two to ten plies, with cover thickness to suit any conditions.

We also manufacture a complete line of industrial rubber products: belting, hose, packing and moulded rubber of every need. *Through your Quaker and Quaker Pioneer distributor* our research and engineering services are available to help you solve any industrial rubber problem. *Write for free folder and name of nearest distributor.*

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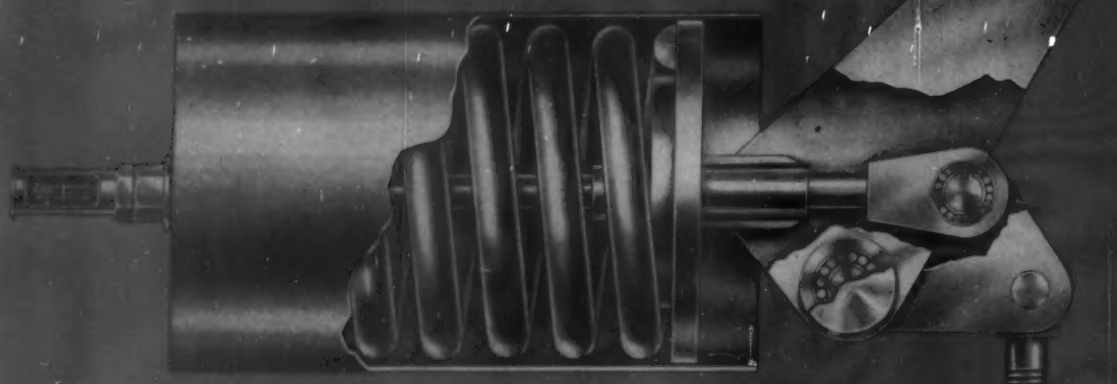


NAVCO Counterpoise*

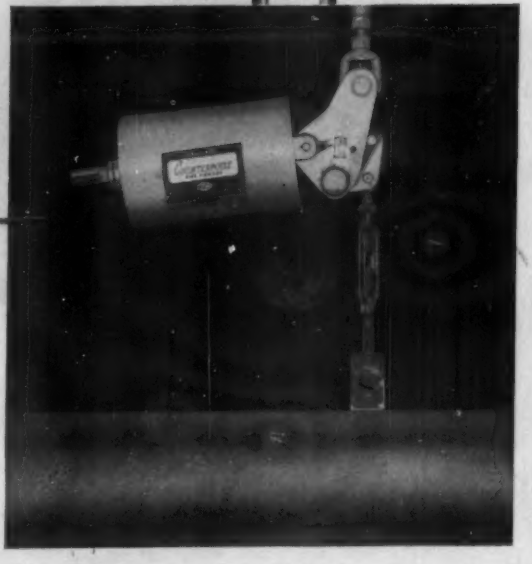
Pipe Hangers

The constant load-carrying capacity of Navco Counterpoise* Pipe Hangers has been proven during an extended period of satisfactory service as the first accurate and efficient support for high temperature piping systems. They are being used extensively in steam generating stations, refineries and chemical plants.

The Counterpoise Hanger is a spring-actuated counterbalance. An ingenious system of linkage transforms the varying force of the spring in an accurate mathematical ratio to produce a load supporting effort of constant value throughout the entire range of expansion travel.

The design permits great flexibility of installation and saves valuable space in congested areas. All parts are ruggedly made and have a high safety factor, yet excess weight and oversize physical dimensions have been avoided to hold space and structural load requirements to a minimum.

The Navco Counterpoise Hanger is available in 16 different frame sizes with load capacities ranging from 200 to 16,000 pounds and expansion travels up to 12 inches. For detailed information on how you can get dependable support with this unique hanger, write today for our 12-page illustrated bulletin #153.



Note above how the flexible top connection permits the hanger assembly to fall in line with the direction of the load pull, so that horizontal travel of the piping has no appreciable effect on the hanger operation. The unit may be positioned at any angle. This affords flexibility in installations where close clearances are a factor.

* *Counterpoise is a trade name of the National Valve & Manufacturing Company*

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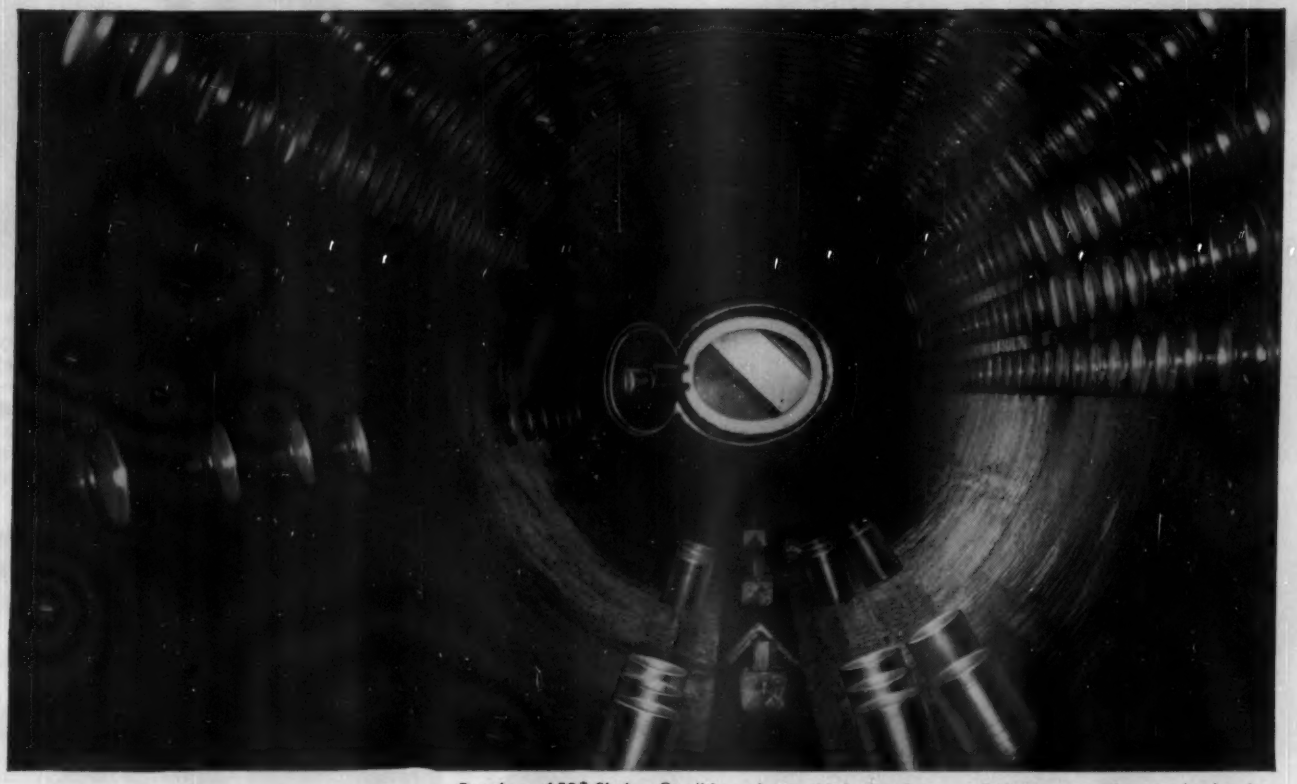

Dearborn 659* Sludge Conditioner keeps this boiler clean...eliminates expensive yearly cleaning.

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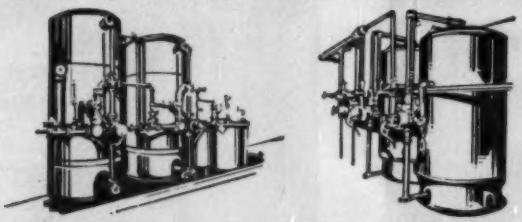
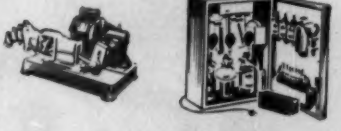


Dearborn has the knowledge and experience to design and furnish complete ion-exchange equipment, including mono-bed and 2-bed demineralizers, sodium-hydrogen split stream softeners, sodium exchange softeners either alone or in conjunction with hot lime softeners.

INTERNAL TREATMENT EQUIPMENT



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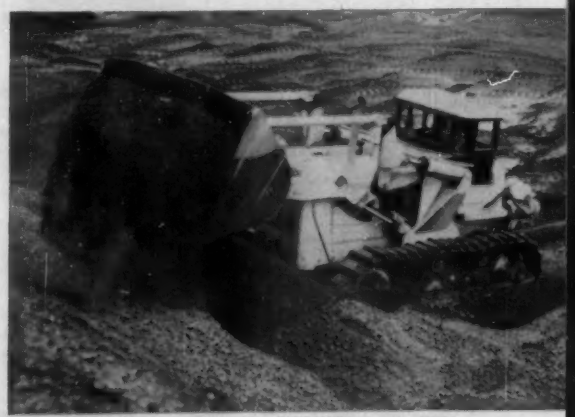
MODERN METHODS of Coal Handling

14 TONS OF COAL AT A TIME is stockpiled or reclaimed at an Eastern utility by this HD-20 Tractor with special Baker coal blade. Blade design takes advantage of tractor's big 175 net engine hp, permits moving up to 15 percent more coal than with regular blade. Repeated trips of 25-ton unit over stockpile compacts coal, helps prevent spontaneous combustion.

COAL IS RECLAIMED AS NEEDED from the storage pile of a Michigan industrial plant by this Allis-Chalmers 109 drawbar hp HD-15 Tractor with Gar Wood straight blade and wings. It moves about 9 tons of coal at a time. Unit also stores coal, which is brought in by rail. Tractor handling of coal is flexible, can either supplement existing facilities or take over complete job. Permits adding storage areas without installing costly conveyors, tracks, etc. — or abandoning them without leaving money tied up in idle equipment.

COKE IS STOCKPILED AT A STEEL MILL leveled and compacted by this Allis-Chalmers 72 drawbar hp HD-9 Tractor — then is reclaimed as needed for the plant. Wintertime operation no longer is hindered by freezing of coke surface as it was with system previously used.



VERSATILE HD-9G WITH 3¾-YD. (2.8-TON) BUCKET builds storage pile of coal brought to Midwest industrial plant by truck. These coal-handling buckets are available for all four Allis-Chalmers tractors, from 2-yd capacity on the HD-5G to 7-yd on the HD-20G. Blades and other attachments are interchangeable with buckets to widen the usefulness of Tractor Shovels.

Find out more about how Allis-Chalmers equipment can improve your coal handling at lower cost. See your Allis-Chalmers dealer for a demonstration right at your plant, or ask to see the color film showing coal-handling equipment at work. Also, send for free booklet, "Economic Coal Storage."

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ELECTRICAL EQUIPMENT

201 **Motor-Generator Reference Book** — Publication 51R7933 is a 50-pp booklet compiled to assist in the selection of motive power to handle most industrial applications. Neither text book nor ordering catalog, this book provides a brief outline of the various types of motors, generators and motor-generator sets, telling their applications and operating requirements. Booklet is generously illustrated and includes performance data, ratings, information on methods of speed control. Allis-Chalmers Mfg. Co.

202 **Motor Lubrication — Three** methods of lubricating electric motors — cartridge, standard open and company's Lubriflush — are compared in 8-pp Bulletin 1848. To demonstrate action of relubrication in Lubriflush bearings, a series of natural color photos of a transparent bearing housing is reproduced. Necessity of annual lubrication is demonstrated photographically. U. S. Electrical Motors Inc.

203 **Wire, Cable Ordering Guide** — General Catalog W-52-3, 186 pp, presents more than 500 different types of wires and cables. Contains comprehensive data on construction and operating characteristics for control and signal cables, cables for construction work, telephone wire and cables, and portable cords. A technical engineering data section is included. Available to qualified power engineers. United States Rubber Co.

204 **Insulation Temperature-Resistance** — Technical Publication 21T4, 16 pp, is an article on temperature-resistance characteristics of electrical insulation. Complete with tables and graphs, gives general information on variations in temperature characteristics, composite nature of electrical insulation, and practicability of temperature compensation. Other chapters deal with determining insulation constants for temperature correction factors, and a practical method of obtaining insulation temperature. James G. Biddle Co.

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INSTRUMENTS AND CONTROLS

205 **Metering and Control Equipment** — Sixteen-pp Bulletin 18 is a comprehensive catalog offering information on company's meters, control equipment and engineering services. It is written for engineers in power plants, public utilities and process plants. Fifteen measured vari-

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ables common to power and process operations form the index for selecting appropriate equipment. Bailey Meter Co.

206 **Boiler Feed Control** — Bulletin 1008, a 12-pp catalog on boiler feed regulators, is illustrated with large application photos and detailed schematic drawings and charts. Relay and direct operation are covered. Case studies of representative boiler loads are presented to show stability of the Flowmatics in controlling feed water automatically. Copes-Vulcan Div., Continental Foundry & Machine Co.

207 **Pneumatic Valve Operator** — This 8-pp bulletin explains operating principles and outstanding features of the Rotomotor positioning operator for throttling control service. Tells how this heavy duty, all-pneumatic operator is designed to combine safety and economy of air operation with the power of a gear driven screw stem. Conoflow Corp.

208 **Easy Reading Gage** — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co.

209 **Instruments, Controls** — Condensed Catalog 1537 offers brief application information on manufacturer's line of instruments. Fully illustrated, covers draft and pressure instruments, flow meters, liquid levels and pressure gages, CO_2 meters, pneumatic transmitters, positioning operators, temperature instruments, boiler feedwater controls, others. Includes references to detailed literature on each type of equipment. Republic Flow Meters Co.

210 **Ideas on Push-Pull Controls** — Included in this "Idea File" are answers to a power engineer's questions on the use of push-pull controls. A general information booklet discusses remote control applications, explains construction and operation of company's Tru-Lay controls. Separate bulletins are devoted to standard assemblies, bracket-type head controls, micro controls and hand-operated controls. Automotive and Aircraft Div., American Chain & Cable Co., Inc.

VALVES, TRAPS, PIPING AND ACCESSORIES

211 **Check Valves** — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principles of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

212 **Lubricated Plug Valves** — Revised Catalog PV-2, 12 pp, presents steel and semi-steel valves designed to offer quick shut-off of erosive or corrosive fluids. Explains advantages of the lubricated tapered plug design of these valves and pictures single gland, screwed gland, and bolted gland types. Also shows accessories. The William Powell Co.

213 **To Get at Those Valves** — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co.

214 **Blow-Off Valves** — Bulletin B-426, 20 pp, on blow-off valves for boiler

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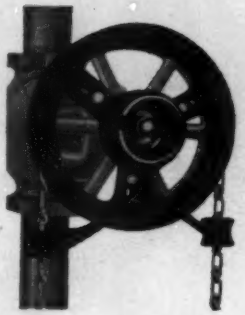

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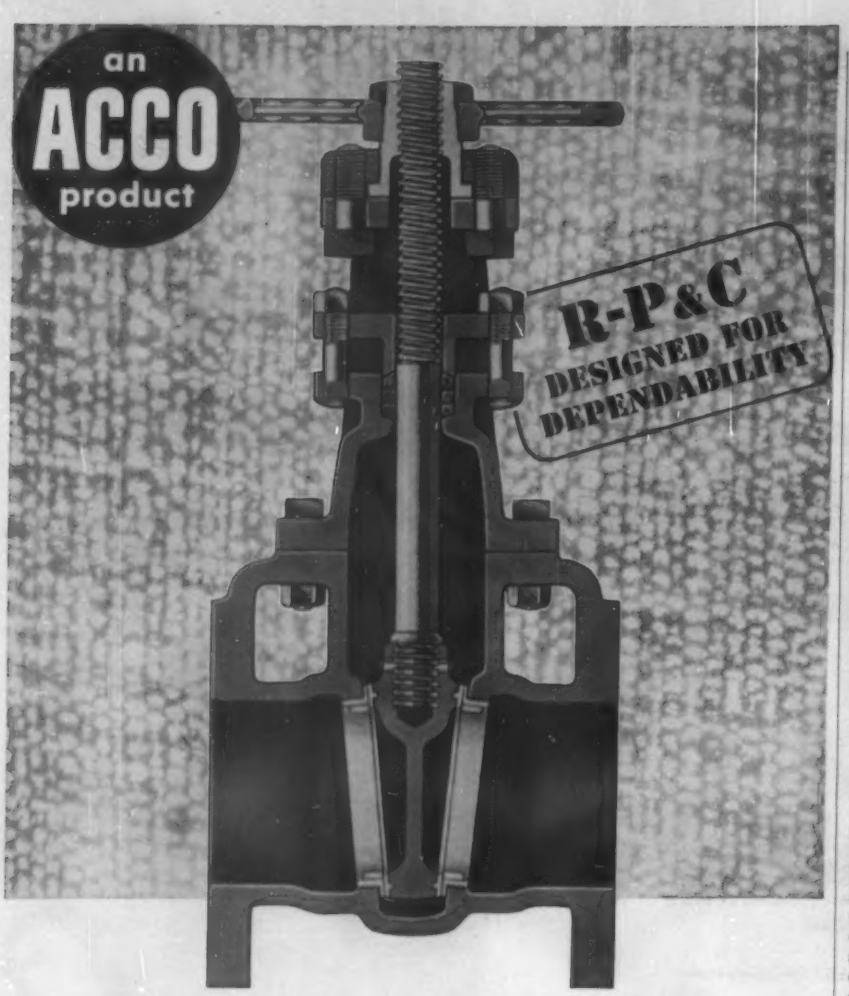

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pressures up to 400 lb wsp, contains installation recommendations, construction information on Yarway seatless and double-tightening blow-off valves. Gives full ordering data. Yarnall-Waring Co.

215 For Precise Control — Fifty-pp Catalog 17 covers manufacturer's line of disc valves and accessories, providing full selection and ordering data, materials of construction, sizes. Describes manual and automatic controls for these valves which, it is noted, are available in any metal which can be cast or welded. Minimum pressure drop, quick closure, simplicity and other advantages are discussed. R. S. Valve Div., S. Morgan Smith Co.

216 Choosing the Right Valve — Presenting valve selection as a matter of matching the valve's service characteristics with service requirements of the job, this practical 20-pp booklet explains and illustrates basic design features of gate, globe and check valves. It tells, in non-technical language, how each of these valve types works, and where it is suited for use. Disc, stem connection, bonnet and bonnet-joint characteristics are also discusseed and the importance of stem operation is treated. Crane Co.

217 Steel Gate Valves — Five types of Hancock general purpose steel gate valves for process and power piping systems are described in illustrated Bulletin 202 B, 12 pp. Material specifications, dimensions given, also service pressure ratings. Manning, Maxwell & Moore, Inc.

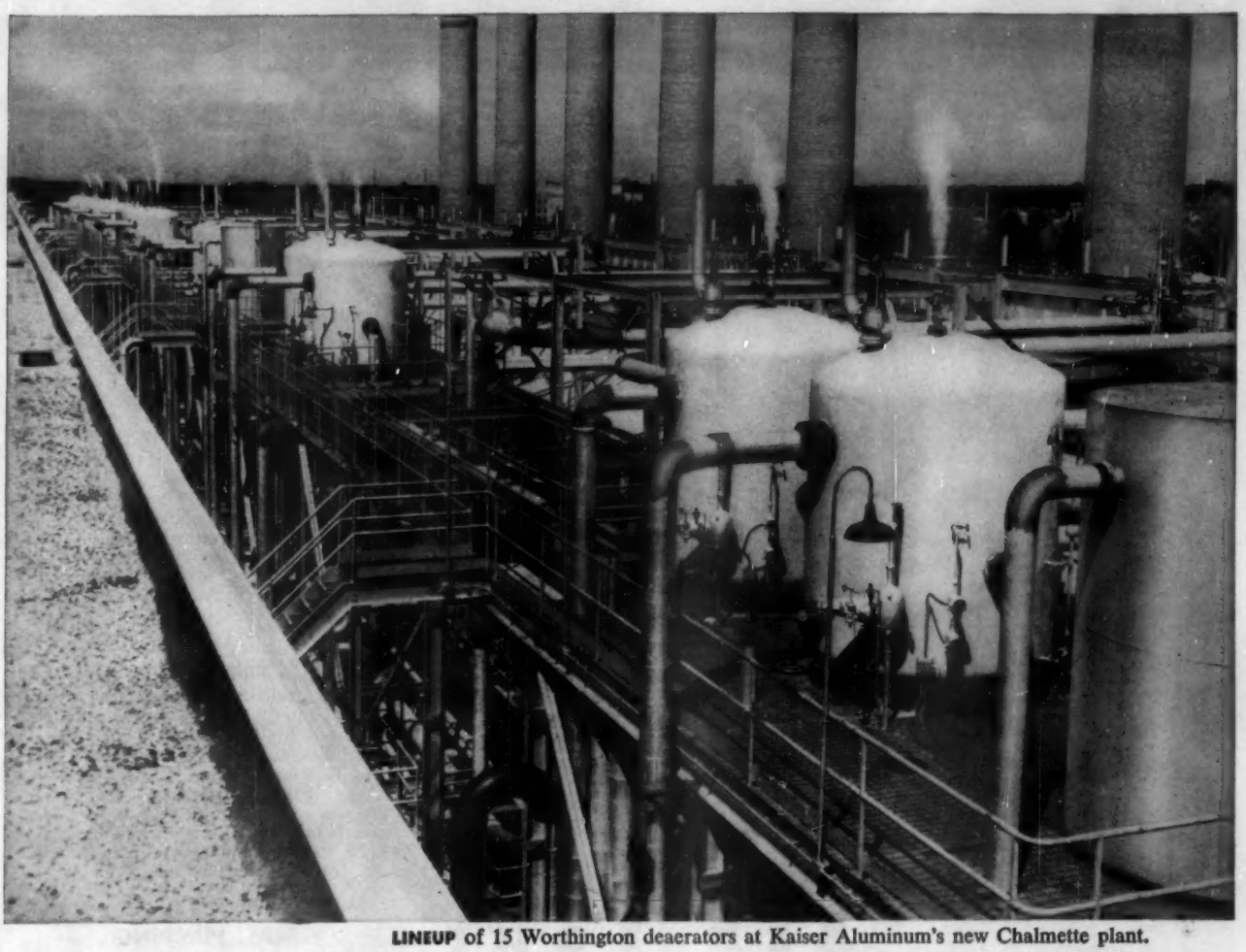
218 General Service Valves — Bulletin E-160, 16 pp, describes and illustrates design and construction of company's quick-operating valves, explaining their application to blow-off service and on chemical process, soot blowers, water column blow-down, and other types of pipe line. Everlasting Valve Co.

219 Industrial Valves — Condensed Catalog 105, 28-pp, contains data on valves for a wide variety of applications. Includes dimensions and illustrations describing non-return (stop-check) valves, globe and angle stop valves, pressure seal design, angle univalves and small size globe valves designed for chain or extension operation in vertical lines. Also included is company's Mudwonder valve for abrasive fluid application in industry as well as mudlines in the oil field. Edward Valves, Inc.

220 Steam Trap Book — Catalog J, 44 pp, serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

221 Industrial Steam Traps — Twelve-pp Bulletin 853 describes steam traps with bellows of bronze, Monel or stainless steel, and bodies in bronze, semi-steel and cast steel construction in sizes ¼ to 2 in., for pressures from vacuum to 300 lb. Included besides capacity tables and dimensions are piping diagrams, typical applications. W. H. Nicholson & Co.

222 Steam Trap Solutions — Bulletin F.151, 36 pp, is a newly revised edition of this company's well known booklet, "Solving Steam Trap Problems." Organ-



LINEUP of 15 Worthington deaerators at Kaiser Aluminum's new Chalmette plant.

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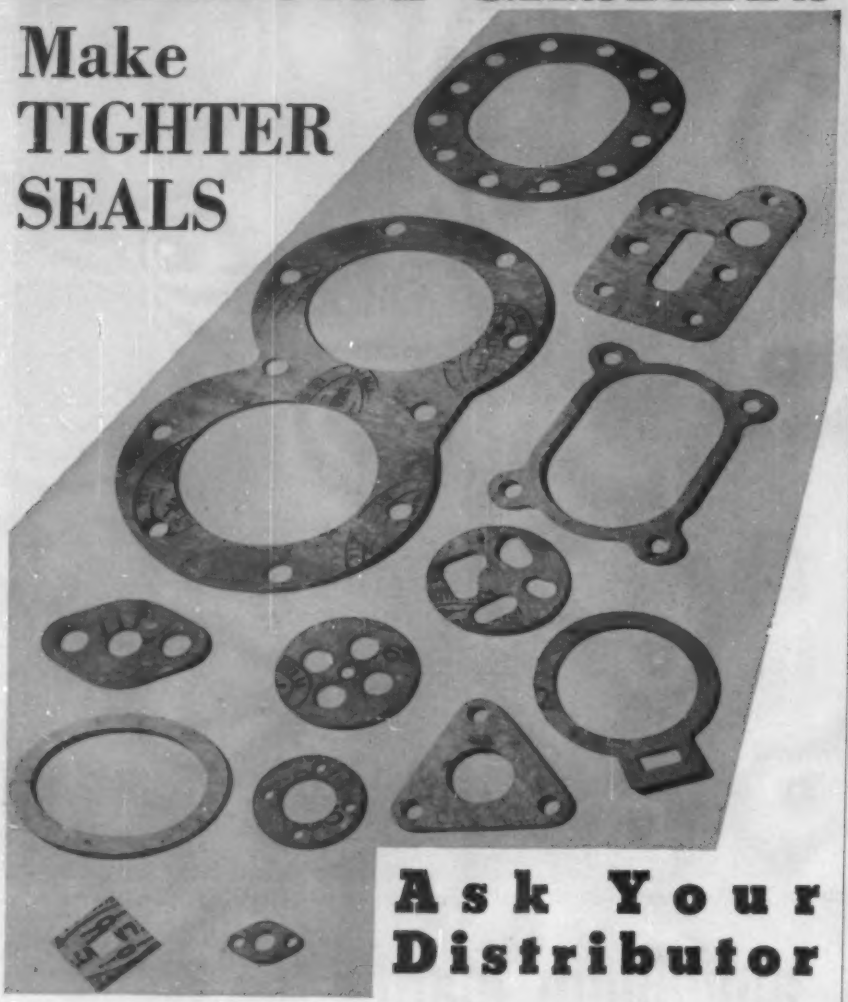

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ized for easy reference, this illustrated booklet provides specifications and capacities of steam and float traps, air release valves, pipe line strainers. Tells how to calculate condensation loads and select traps for unit heaters, jacketed kettles, submerged surfaces. Gives pointers on installing and servicing traps. The V. D. Anderson Co.

223 Unions and Fittings — Twelve-pp Catalog 50 covers manufacturer's line of unions of all types, elbows, tees and fittings. It describes and illustrates special features. Dart Union Co.

224 Forged Fittings — Literature is available on screw-end and socket-weld fittings. Stresses economy and other advantages of these fittings, lists steels available. Watson-Stillman.

225 Welded Fittings — Catalog 3 is a 36-pp ordering and engineering reference book on company's Weldolets for piping services. Gives data on butt-welding and socket welding Weldolets as well as on Thredolets for making threaded outlets. Typical installations are pictured; sizes, weights and prices provided. Also included are installation instructions and a technical section. Bonney Forge & Tool Works.

226 Improved Pipe Hanger — Twelve-pp Bulletin 153 describes company's Counterpoise pipe hanger for high temperature piping systems in steam generating stations, refineries and chemical plants. Tells how it offers efficient load supporting effort of constant value throughout entire range of travel as pipe expands or contracts because of temperature changes. Graphs for selecting proper hangers are given. National Valve & Mfg. Co.

PUMPS, PUMPING

227 Boiler Feed Pump — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up is the subject of 12-pp Bulletin 1525. De Laval Steam Turbine Co.

228 Gear Pumps — Besides presenting all of company's standard gear pumps, 24-pp Bulletin 17-A describes briefly some special types engineered for unusual requirements. Discusses design, construction and operation of the pumps; tells how they're used in the power and industrial fields. Drawings, action photos, capacity and pressure tables and performance data supplement the text. Booklet covers pumps ranging from 1 gph to 1000 gpm capacities. Schutte and Koerting Co.

229 For Abusive Pumping Jobs — Catalog 4906, 36-pp, covers centrifugal pumps for wide, industrial use and especially adapted to handling ashes, abrasive mixtures, slurries, hot and corrosive liquids. It describes several basic types; a horizontal shaft, single-stage side suction pump; a horizontal shaft, single-stage, rear-entrance automatic priming pump; vertical shaft pumps with standard, overhead and quill bearings for wet pit applications. Nagle Pumps.

PACKINGS, GASKETS, SEALS

230 Seals for Bearings — Complete information on manufacturer's Klozure oil and grease seals for bearings is available in 100-pp Catalog 10. Fully illustrated in color, pictures all types of these seals,

typical applications and lists sizes and part numbers. Also describes mechanical pressure seals for rotary shafts. The Garlock Packing Co.

231 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing specific recommendations for many applications. Packing Div., Raybestos-Manhattan, Inc.

WATER CONDITIONING

232 Handbook on Demineralizing — Bulletin 5800, 39 pp, on treating water by demineralizing, explains principle of ion exchange. Discusses applications of many anion and cation exchange materials; series of curves help estimate cost of operation. Describes design and operation of demineralizer systems, multi-stage systems and mixed bed units. Includes curves of water quality obtainable. Cochrane Corp.

233 Modern pH and Chlorine Control — This 100-pp booklet gives details in color comparators and equipment in water testing and control of boiler and industrial process water, also technical information on meaning of pH control, electrometric and colorimetric methods of determining pH and impurities in water; applications of water control in air conditioning; feedwater. W. A. Taylor & Co.

234 What's What on Ion Exchangers — Here are three booklets on ion exchangers: Nalcite HCR, a styrene type cation exchanger; Nalcite SAR, a strongly basic anion exchanger; and Super Nalcolite, a synthetic gel type zeolite for cation exchange. Tables and graphs explain performance of these water treating resins under various operating conditions. Physical characteristics, exchange capacities, regeneration techniques discussed. Bulletin 57, 20 pp, is on Nalcite SAR; Bulletin 58, 28 pp, Nalcite HCR; Bulletin 59, Super Nalcolite. National Aluminate Corp.

Postage-free cards for ordering catalogs are on pages 99-100. You may also use the cards to ask for advertised literature.

235 Water Conditioning Data Book — An excellent reference volume, Data Book 2478A contains 108 pp and presents a compilation of 78 chapters and tables. Subjects covered include hydraulics; impurities in water; chemical conversions; coagulant, acid and alkali dosages; chemicals used in water treatment; water treatment processes; boiler feed make-up requirements; alkalinity relationships; specific gravities; chemical reactions. Available to qualified power engineers, please state your job title when requesting this. The Permutit Co.

236 Testing Equipment — Designed for use as a guide in the selection of water testing equipment, this 12-pp bulletin describes complete line of titration stands and test sets for hardness, alkalinity, chloride, sulfide, etc.; cabinets and test sets for similar tests; Conducto bridge for determination of specific conductance of water solutions. W. H. & L. D. Betz.

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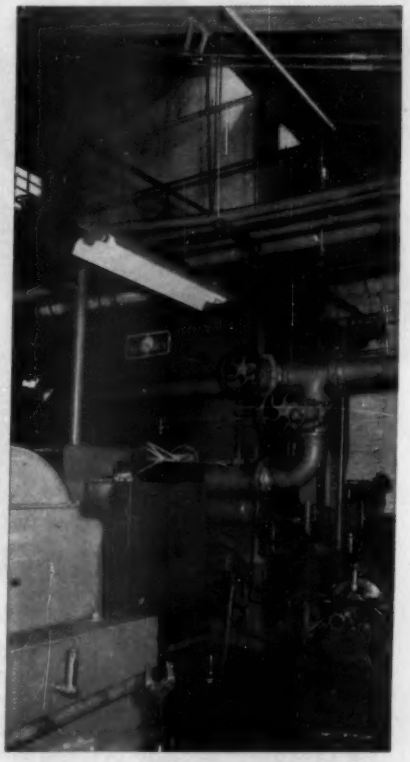

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237 Corrosion Treatment — "Corrosion Protection of Steam and Condensate Return Systems" is a folder on amine treatment for boiler and condensate systems. This treatment is described as affording surface protection of the metal as well as raising pH value of condensate. The Bird-Archer Co.

238 Demineralizers — Valuable information on demineralization is offered power engineers in comprehensive 24-pp Bulletin WC-111. Discusses demineralization in general and its advantages and applications. Basic types of demineralizers and their special uses are charted. Resins, piping, valves and accessory equipment are treated in detail. Book also provides flow charts showing demineralization systems for chemical plants and power plants. Graver Water Conditioning Co.

239 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pretreatment, internal treatment, treatment application, blow-down adjustment, test control. Dearborn Chemical Co.

BOILERS, GENERATORS

240 Shop-Assembled Boiler — Sixteen-pp Bulletin G-76 completely describes and illustrates company's Type FM water-tube integral-furnace boiler, made in standard sizes from 2900 to 28,000 lb of steam per hr, pressure to 250 psi. The Babcock & Wilcox Co.

241 Packaged Boilers — This 16-pp illustrated catalog describes manufacturer's new Type VP package boiler. Following a section of background information is an outline of the principal design features of these boilers, which are shop assembled and provide steam capacities from 4000 to 30,000 lb per hour. Space requirements are shown in a table along with typical specifications. Also described is control system. Combustion Engineering, Inc.

242 Improved Steam Generator — Bulletin 2000, 28 pp, explains advance design features that distinguish this manufacturer's generator from other unit steam generators. Describes and illustrates engineering differences of component features. Also shows how these components are constructed, assembled and tested. Another section gives data, and dimensions for the units which range from 20 to 6000 hp. Preferred Utilities Mfg. Corp.

243 Automatic Boilers — This bulletin describes 17 sizes of Powermaster packaged automatic boilers from 15 through 500 hp for steam process, steam and hot water heating service. Lists such advantages as three-pass design, forced draft and automatic controls. Describes firing equipment for light and heavy oils, gas; shows various fuel firing arrangements. Orr & Sembower, Inc.

244 Steam Generators — Illustrated Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-tube boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cut-away illustration shows design details, and gas travel. Erie City Iron Works.

245 Scotch Marine Boilers — Bulletin 236 illustrates and describes a Scotch type of boiler on skids suggested for a wide

range of applications. This boiler can be hand- or stoker-fired with coal or can use oil, gas or wood as fuel. Gives construction details, stresses versatility, other advantages. Includes test data and specifications. The James Leffel & Co.

246 Steam Generator — This manufacturer's new Type D steam generator, a packaged unit for pressure firing with gas, oils or combination of fuels, is described in an 8-pp catalog. Gives complete data and dimensions on this water tube generator which is available in 17 sizes with capacities from 8000 to 40,000 lb of steam per hour. Fully illustrated, booklet explains economical steam production, low installation cost, other advantages. Provides details on controls and combustion equipment which may be selected. Superior Combustion Industries Inc.

TUBING AND ACCESSORIES

247 Condenser Tubes — Excellent information on condenser tubes and their service life is given in this 40-pp illustrated booklet. Subjects discussed include corrosion of condenser and heat exchanger tubes, corrosion resistance and control, the selection of tube materials, and the composition and physical properties of company's alloys. Gives details on proper installation. Scovill Mfg. Co.

248 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads. Roto Div., Elliott Co.

249 Data on Stress Values — Data Card 154 is designed to help power engineers concerned with the operation of tubular equipment at elevated temperatures and pressures. The card is an adaptation of Table P-7 of the new ASME Boiler Code and is complete with notes and formulas for calculating maximum allowable working pressures. Tubular Products Division, The Babcock & Wilcox Co.

250 Nickel Pipe and Tubes — Bulletin T-17 is a 27-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

251 Tube Cleaners — Catalog 76-A provides 48-pp of information on manufacturer's line of tube cleaners. Following equipment selection and operating hints, this practical catalog describes and pictures cutter heads and drill heads, brushes, and motors, giving sizes, application information. Air valves, hose, lubricators are described. Thomas C. Wilson, Inc.

COAL, ASH HANDLING

252 Economic Coal Storage — How tractors establish safe, orderly coal handling is told in this 8-pp booklet. Stresses flexibility, low operating costs. Also shows how tractors speed storage reclamation and how a tractor-scraper combination offers plus benefits. Illustrated with action photos; pictures several models. Tractor Div., Allis-Chalmers Mfg. Co.

253 Spreader Stoker Selection — Fourteen-pp Form F-520-A10M is intended to help those choosing a spreader stoker to get the most for their investment,

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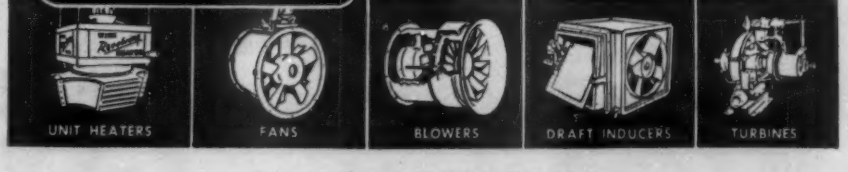

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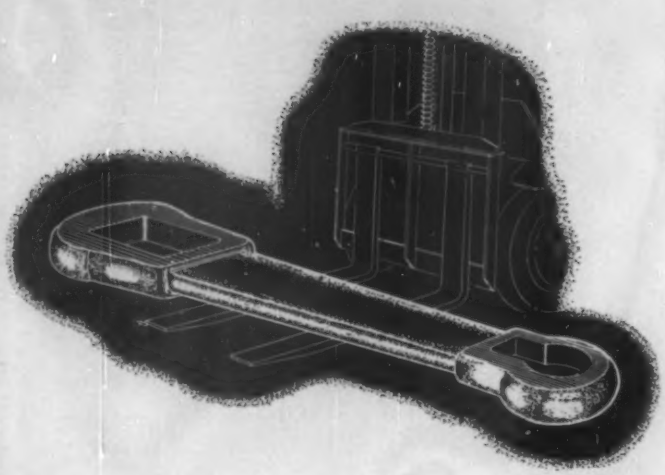

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and it points out many factors to be considered. American Engineering Co.

254 Automatic Coal Scale — Sixteen-pp Bulletin 0352 describes an automatic coal scale for weighing coal as it is fed to boilers, enabling a power engineer to maintain a constant check on boiler efficiency. Book gives construction and operating details on the belt feeder, weigh hopper, scale housing, operating levers and accessories. Photos and line drawings show scale features. Richardson Scale Co.

255 Spreader Stoker Data — This is a file of three illustrated bulletins on spreader stokers. The first discusses seven reasons for selecting these stokers and describes their design, construction and operation; the second, dumping grates, the third, installations. Riley Stoker Corp.

256 Pneumatic Handling System — Of value to power engineers concerned with the handling of dry pulverized materials, 16-pp Bulletin G-2 tells how handling costs can be reduced by using the proper pneumatic handling system. Lists 86 dry pulverized materials and indicates which of three systems is best suited to handle each material. Discusses company's system for conveying such materials as Portland cement, pulverized coal. Fuller Co.

257 Burning Bituminous Coal — This 24-pp illustrated booklet is a compilation of numerous actual case histories of industrial plants and institutions which burn bituminous coal "the modern way." Stressing operating economy achieved, these case histories show problems overcome, equipment used, and savings realized. Bituminous Coal Institute.

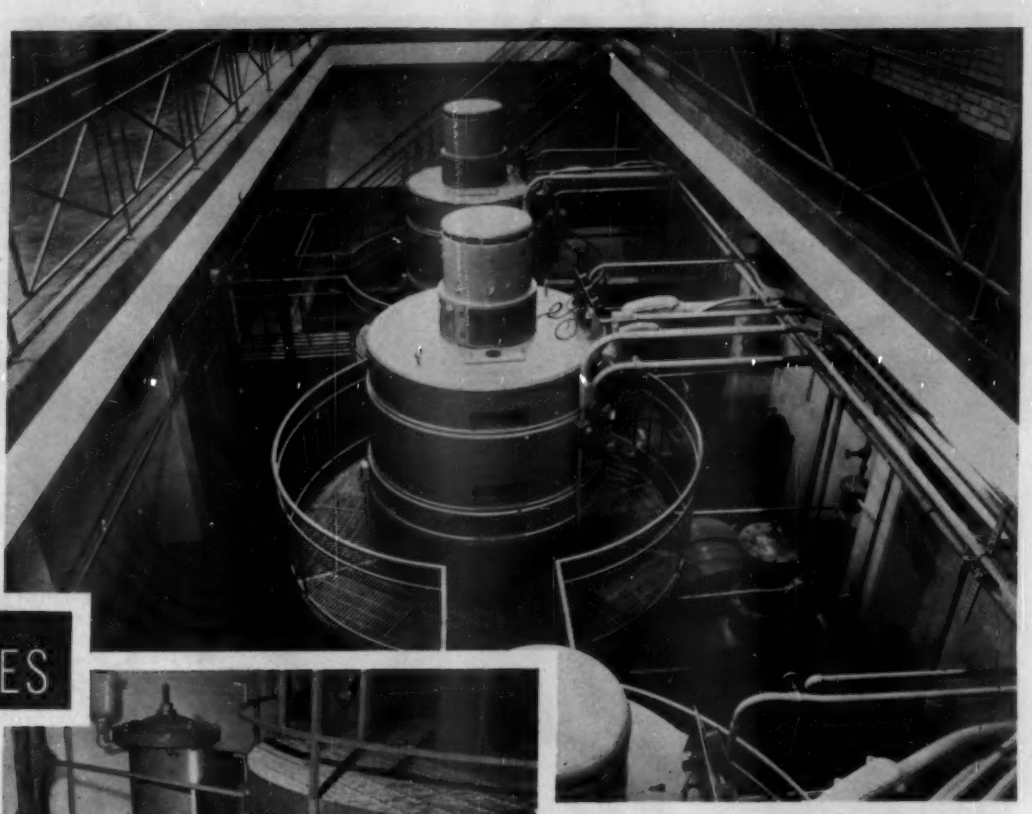
258 Fly Ash Collection — The successful and economical separation of fly ash from boiler flue gases is discussed in 28-pp Catalog G405. Explains need for collection equipment and gives physical characteristics of fly ash. Describes company's Multiclone equipment as to principle of operation, performance and advantages. Western Precipitation Corp.

259 Why Liquid Diffusion — What liquid diffusion can do for power plants is explained in Form B, which tells how liquid diffusion compounds work and gives four practical applications. These include dust control in coal handling, fly-ash control, coal storage pile treatment and boiler cleaning. Johnson-March Corp.

REFRACTORIES

260 Refractory Concrete — Basic information on recommended practice for mixing and placing refractory concrete, used in the metal, power, ceramic, and petroleum refining industry as a material to withstand service temp to 2600 F or more, is presented in this 16-pp manual. Sections are devoted to special properties of refractory concrete, aggregates, refractory insulating concrete, and structural design. Charts and tables afford easy reference for technical data. Universal Atlas Cement Co.

261 Refractories for Heat, Power — Compiled to help power engineers solve refractory problems and get greater operating efficiency from their boilers, this booklet provides 32 pp of practical information on company's Crystolon refractories. Properties and characteristics of these silicon carbide products are given and separate chapters cover those for air-



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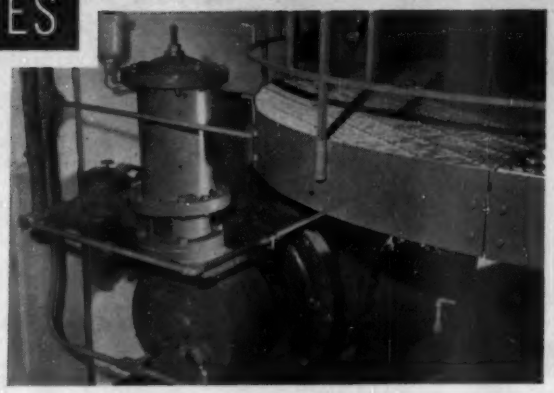

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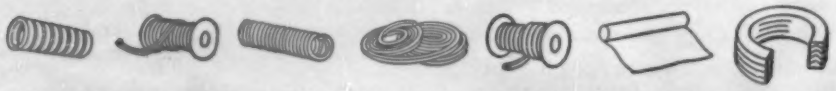

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cooled, solid wall and water tube protection, and for repairs. Norton Co.

FUEL OILS, LUBRICANTS

263 Diesels, Their Fuels and Lubricants — This 46-pp book gives practical information on diesel engines, covering their history and economics as well as design characteristics and operating principles. Classification of diesels according to speed is covered. A chart shows relation of engine performance to fuel properties. Sinclair Refining Co.

264 Petroleum Pitch — This illustrated article on petroleum pitch as a boiler fuel stresses its low cost, other advantages. Explains combustion of pitch; discusses unloading method, burning, storage, fuel oil treatment, also precautions in handling hot pitch. Kor Corp.

265 Turbine Lubrication — The special problems of turbine lubrication are discussed in 8-pp Bulletin TU-1. Tells how purifiers keep power units in service; discusses inhibited and uninhibited oils, company's process for reducing sludge formation within lubrication system. Illustrated with diagrams of typical installations. DeLaval Separator Co.

266 Versatile Industrial Oil — Described in 20-pp Form AD 4078 is an all-purpose oil offering protection for a wide range of industrial equipment, and available in 15 viscosity grades. Discusses six major characteristics of the oil; explains and pictures its use in hydraulic systems, speed reducers, air compressors, electric motors, hydraulic turbines, bearing systems, etc. A chart shows grades available, their uses and physical properties. Standard Oil Co. (Ind.)

267 Bearing Lubrication — Vol. XL, No. 10 of this company's Lubrication magazine provides an excellent 12-pp article on industrial bearing lubrication. Illustrated with photos and drawings, text covers such subjects as bearing design; bearing surfaces; bearing overhaul; aspects of lubrication, including factors involved in choice of turbine oils and diesel lubricants, and the deleterious effects of moisture; and the life expectancy of bearing lubricants. The special requirements of porous bearings are also discussed. The Texas Co.

268 Air Compressor Lubrication Manual — Valuable information on air compressor maintenance is contained in this 40-pp book. Subjects treated include compressed air, compressors and related equipment, lubricating systems, compressor oils and applications, lubrication requirements, operating hints, oil requirements, storage and care of compressor oils, also safety precautions. Cities Service Petroleum, Inc.

269 Cooperative Technical Consultation Service — This informative 24-pp booklet presents company's periodic consultation service aimed at the most efficient use of petroleum products. Covers services available in the solution of lubrication problems, metal working operations, processing, fuel oils, dust control. Gulf Oil Corp., Gulf Refining Co.

OTHER EQUIPMENT

271 Oil and Gas Burners — Bulletin OB-53, 28 pp, gives principles of selection and application of oil or gas burners, or a combination of both for standard and

wide capacity range operation, together with air registers and fuel oil heating and pumping sets. Conversion table shows approximate relationships between quantity of oil burned, boiler capacity and air required for combustion. Specifications included. The Engineer Co.

273 Refrigerator Condensers — Bulletin RC-2, 38 pp, utilizes drawings, tables and engineering data to show how to select proper type from company's line of ammonia and Freon condensers for refrigeration services. Illustrates horizontal multipass shell and tube types; vertical singlepass shell and tube types. Gives pipe sizes for ammonia and Freon lines; stands for condensers. Henry Vogt Machine Co.

274 Turbine Speed Control — Thirty-pp wire-wound Bulletin H-21 is titled, "Fundamentals of Turbine Speed Control." It is an elaborately illustrated, educational booklet intended to clarify the operation of common types of automatic speed control for steam turbines. An introductory section covers general fundamentals of automatic control systems, and includes a key to control terminology. Simplified diagrams show operating principles of actual control systems. Elliott Co.

275 Belt Conveyor Carriers — Carriers designed for rugged jobs, exposure to dust and long service are the subject of illustrated Bulletin 453. Shows how their spun end rolls and welded steel frame contribute to extra strength and better balance. Stephens-Adamson Mfg. Co.

276 Preheating Combustion Air — This well-illustrated 36-pp booklet explains fuel savings and increased performance made possible by using waste heat

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in flue gases to preheat incoming combustion air. Also covers increased boiler output, ability to use lower grade fuels, other advantages afforded. Booklet contrasts regenerative with recuperative preheaters; explains operating principle and structural details of the Ljungstrom air preheater. Applications for other than power boilers are also covered. Air Preheater Corp.

278 Power Plant Equipment — This comprehensive folder illustrates some of the equipment and services provided by this company. Shows heat exchangers, filters, condensers; also such services as re-tubing and metal spraying. Condenser Service & Engineering Co., Inc.

279 Conveyor Belt Chart — Engineering data for standard conveyor belt constructions is given in this chart and accompanying sheet. Strength characteristics of eight popular ply and material combinations of conveyor belt constructions are provided. Each property is printed on the chart in a different color to facilitate comparison. Quaker Rubber Corp., Div. H. K. Porter Co., Inc.

280 Protection Against Rust — This bulletin describes and gives application data for Z.R.C., a coating applied to iron and steel to provide a dried film protective coating of 93 to 95 per cent pure zinc. Details surface preparation, coverage, finish. The Sealube Co.

281 Water Heaters — Illustrated 6-pp Bulletin 70, Section I, on instantaneous type water heaters contains detailed capacity and dimension tables for two-, four- and six-pass designs, removable tube bundles. Davis Engineering Corp.

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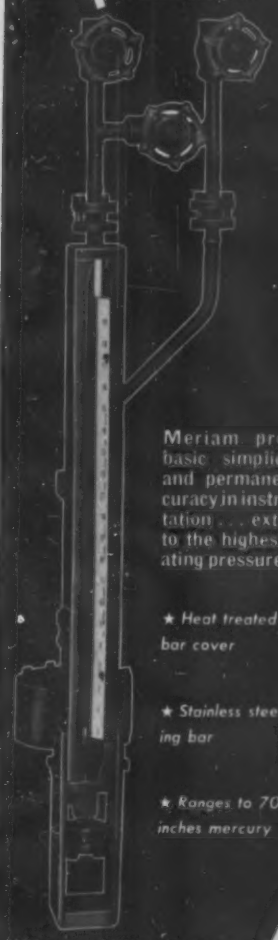

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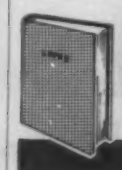

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284 For Climate Control — Bulletin 122, 8 pp, introduces an air conditioner designed for precise and economical control of air temperature and moisture. Illustrates design of the new machine, tells its features, and pictures some installations. Niagara Blower Co.

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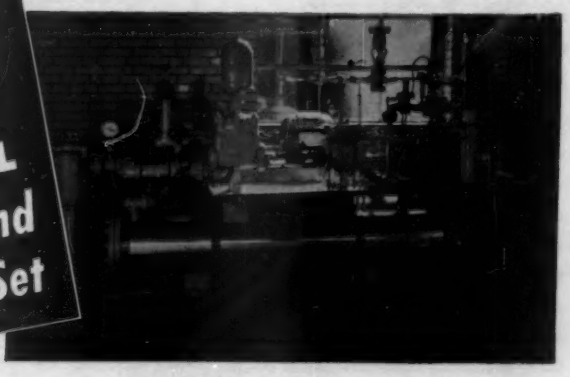

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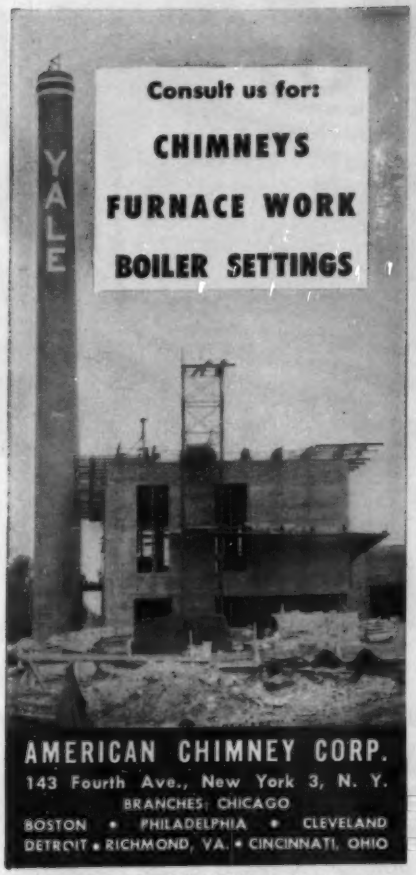

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"See What Goes On Inside"

For insertion into pipe

FOR EVERY APPLICATION

BRONZE, IRON, STEEL, STAINLESS STEEL

FIG. 29 Cylinder with Impeller

FIG. 17-28 Cylinder

FIG. 215 Flanged

FIG. E-57 Double Window

FIG. 212 Visibility Welding Neck or Screw

FIG. E-811 Flapper

FIG. E-1810 Rotating Wheel Type

All sizes up to 6" *Send for Catalog*

ERNST WATER COLUMN & GAGE CO.

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NEW

Arnold O. Beckman

MODEL F3

OXYGEN ANALYZER

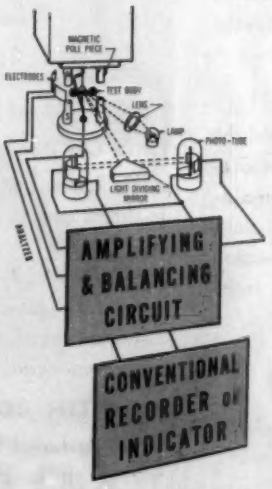
with the meter on the door

New convenience has been built into the well-known F3 Oxygen Analyzer... a meter on the door provides readings at the sampling point for making calibration checks, process changes, etc. In fact, complete analyzing, calibrating and indicating components are now incorporated into the single F3 unit—at no extra cost!

Use The Model F3

ON OPERATIONS LIKE THESE... TO MAKE SAVINGS LIKE THESE

COMBUSTION **Boilers, Kilns, Direct-Fired Heaters, Stills, etc.**	*Higher combustion efficiencies at lower fuel costs*
PROCESSING **Air Liquifraction . . . Processing Butadiene, Acetylene and Similar Gases**	*Better product quality with minimum oxygen or air contamination*
PLANT SAFETY **Hydrogenation, Hydrofining, Gas Compressors, Sulfur Grinding, etc.**	*Control explosive atmospheres, reduce fire risks, minimize plant and personnel hazards*



Unique Operating Principle

The various applications highlighted above are only a few of the many ways Arnold O. Beckman Oxygen Analyzers—industry's great new profit builders—are being used by progressive operators to boost profits, cut costs.

These are the *only* oxygen analyzers that *continuously* measure process streams by an advanced magnetic principle that provides *direct physical measurement of the oxygen itself*—not of some secondary relationship.

Heart of the unit, as illustrated, is a dumbbell-shaped test body suspended in a magnetic field. Sample gas surrounding this test body causes it to rotate in the field, depending upon the oxygen content of the gas. The movement of a light beam, reflected by a small mirror on the test body, is measured by simple electronic circuits... and the result indicated directly on a conventional recorder or indicator. It's simple, positive, accurate!

No chemicals—filaments—catalysts cams—complicated mechanical parts!

FEATURES OF THE F3

Many Ranges: Full scale ranges of 0-5%, 0-10%, 0-15% O_2 and higher.

Accuracy: 1% of full scale.

Multi-Ranges: Any instrument may be supplied with two or more ranges.

Note: For ranges narrower than 0-5% O_2 ask about the Model G2.

***Send for Helpful Free Literature** which describes this unique operating principle in detail—explains its many advantages and applications. When writing, outline your particular operations—we'll gladly supply specific information.*

Ask For Data File 16D-35

Arnold O. Beckman INC

Instruments for Science and Industry

1020 MISSION STREET

SOUTH PASADENA, CALIFORNIA

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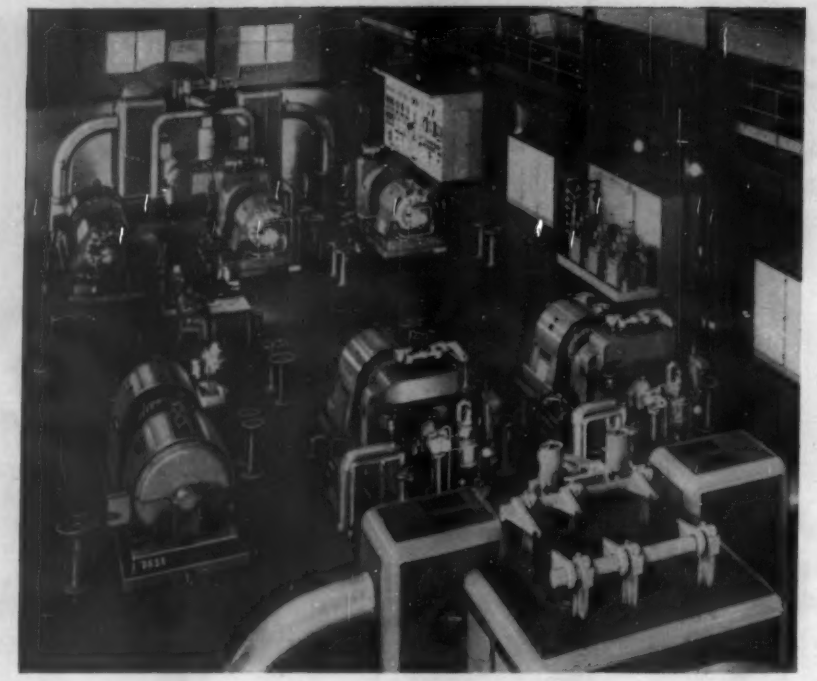
What makes a barrel-type boiler feed pump *stay in service?*



Here are some of the design features that assure dependability

Today's modern multi-stage centrifugal pumps for boiler feed service are the result of years of research and design. To provide efficient service *plus* dependability, De Laval has incorporated these important features in its barrel-type pump.

Double Volute Diaphragms

Double volute diaphragms provide for radial hydraulic balance and assure a continuous rising head characteristic from the design point to shut-off. *RESULT—Higher efficiencies are maintained over a wider range of operation than are generally obtained with other forms of velocity pressure conversion.*

Individual Diaphragm Bolting

Elimination of rabbet fits and gaskets permits straight metal-to-metal contact of adjacent lapped faces of the diaphragms which are individually bolted together to maintain tight joints and ease of assembly. *RESULT—Positive assurance against inner case leakage, complete elimination of misalignment causes and a minimum of distortion from sudden temperature changes.*

Positive Sealing Between Suction and Discharge Chamber

Inner assembly is held at the inner high pressure joint at the suction end of the barrel, against a flexitallic gasket, with through bolts. The joint between the suction and discharge chambers is made tight during assembly—remains tight whether pump is operating or idle. *RESULT—No possibility of leakage or gasket loosening due to changes of force on the inner joint.*

Bare Shaft

Bare shaft construction with split ring-shrink fit method of impeller mounting permits a scalloped shaft design and eliminates the need for spacer sleeves between impellers. *RESULT—Better hydraulic conditions at the eye of the impeller and elimination of spacer sleeves—the greatest cause of shaft warpage.*

Wearing Rings

Diaphragms and impellers have renewable wearing rings. Impeller rings are threaded on the impeller hubs against rotation, and diaphragm rings are held by a breech lock fit in the diaphragms. *RESULT—Construction permits renewal of original clearances without major part renewal or modification. Labyrinth type diaphragm ring results in minimum leakage over a longer period of time than with close clearance flat rings.*

IMO Oil Pump

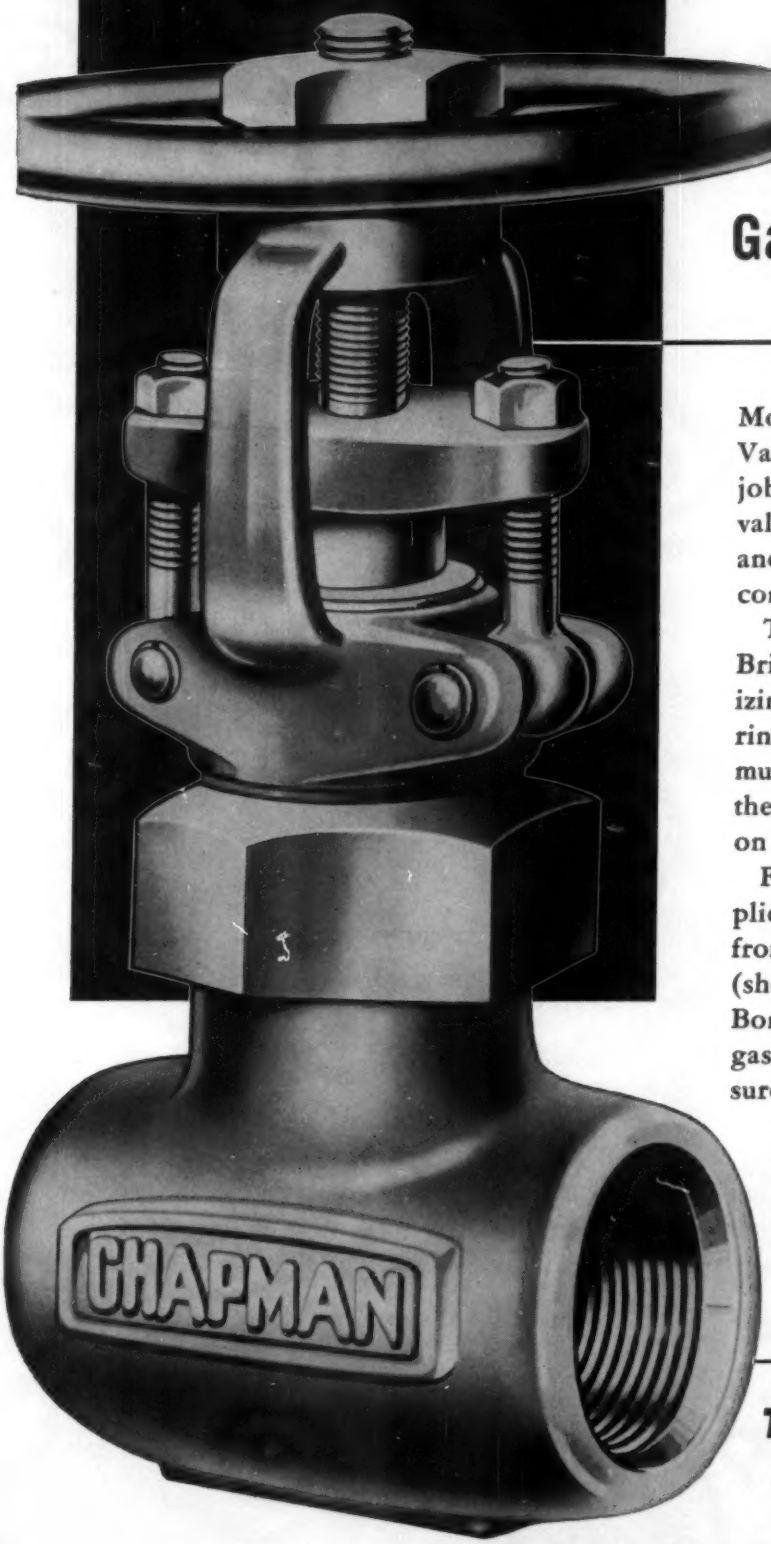
A De Laval IMO pump designed for high speed operation is direct-connected to the outboard end of the barrel pump shaft, and is sized to lubricate both pump and driver bearings. *RESULT—Quiet, pulsation-free, positive displacement IMO pumps, assures positive lubrication and eliminates the need of extra shaft length and mechanical complications required by gear drive lube oil pumps.*

BULLETIN CONTAINS HELPFUL DATA

This De Laval bulletin on the barrel-type boiler feed pump covers all major design points . . . has cross-section cut-away illustration for easy reference. Write on your business letterhead for your copy of Bulletin 1506 to De Laval Steam Turbine Company, 816 Nottingham Way, Trenton 2, New Jersey.

For more data circle 574 on Post Card

Chapman List 960



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The wedge gate faces — hardened to 800 Brinell by Chapman's exclusive Malcomizing process — won't seize or gall. Seat rings are hardened stainless steel, for minimum wear, and are easy to replace. Also, the bolted follower has no exposed threads on the yoke to corrode.

For every small forged steel gate valve application, specify Chapman List 960. Sizes from ¼" to 2", either rising stem with yoke (shown) or rising stem with inside screw. Bonnet joint is ground metal-to-metal or gasketed, depending on application. Pressure range is from 380 psi at 1000°F to 2000 psi at 100°F. For higher ratings, specify List 990.

List 960 is made in various alloys and combinations of alloys as listed in Catalog No. 10. Write for your copy today.

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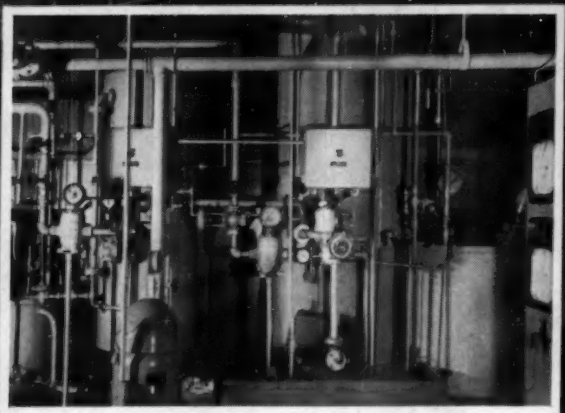

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